

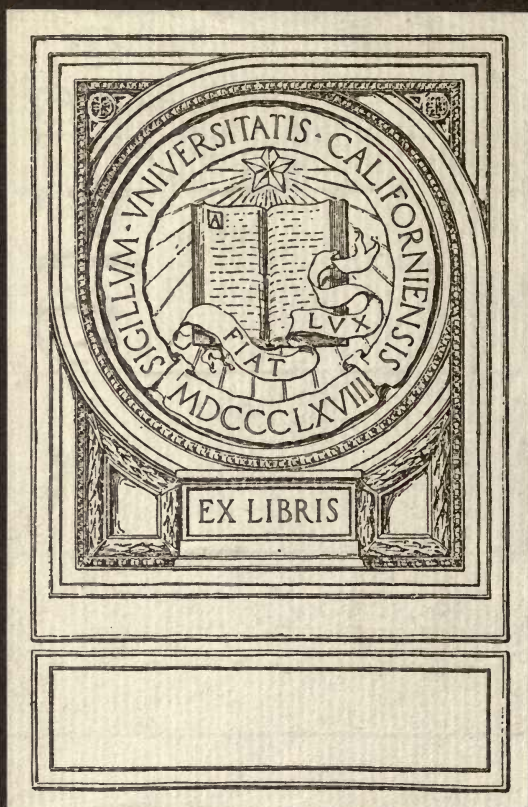
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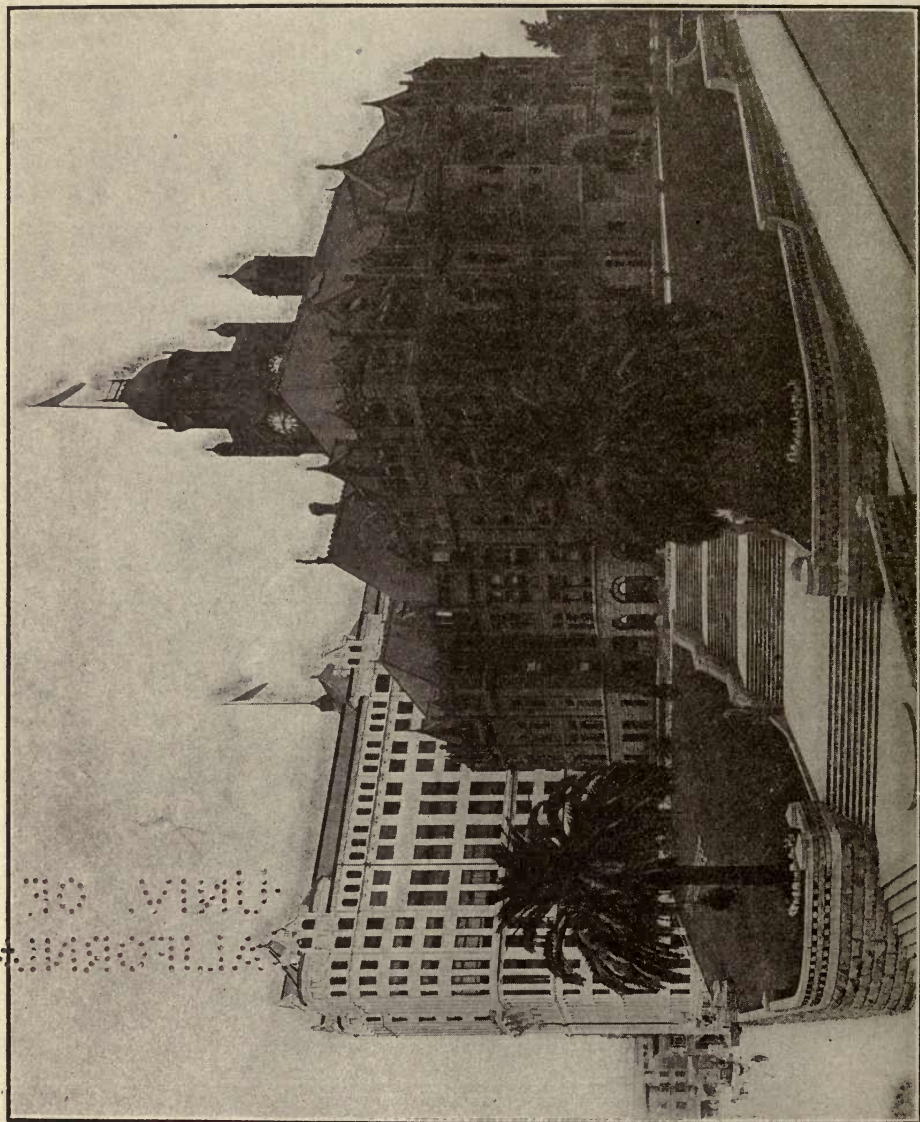
BULLETIN
OF
LOS ANGELES COUNTY
HORTICULTURAL COMMISSION

THE
HORTICULTURIST'S
HAND BOOK

Bulletin No. 1

1913

Univ. of
California



HALL OF RECORDS.

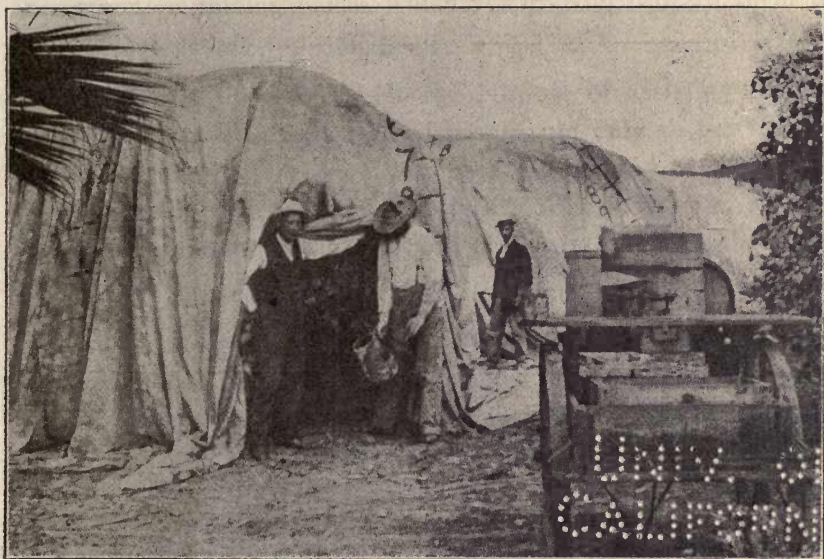
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COURT HOUSE.

LOS ANGELES COUNTY
COMMISSION OF HORTICULTURE

WILLIAM WOOD, COMMISSIONER

THE
HORTICULTURIST'S
HAND BOOK



EDITED AND COMPILED

By

B. R. JONES

Deputy Commissioner of Horticulture

Published by

THE BOARD OF SUPERVISORS

LOS ANGELES

1913

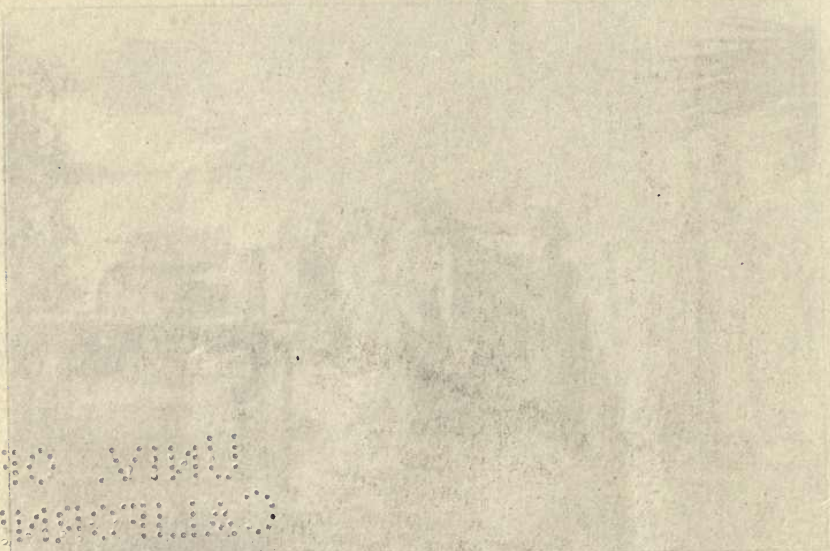
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LOS ANGELES COUNTY
Commission of Horticulture

WILLIAM WOOD, COMMISSIONER

THE HORTICULTURIST'S HAND BOOK



City of
California

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Introduction.

By means of this little book the Horticultural Commissioner of Los Angeles County and his staff send greeting to everyone interested in growing plants and trees into whose hands the book may fall, and more especially the careful painstaking fruit growers who have figured so largely in making this and adjoining counties the attractive abiding places which are drawing toward them the appreciative people from all lands.

Our office is in business for the purpose of assisting the tree and plant grower in every way possible, not only to get the best results for the present time, but to keep his, and his neighbors' trees in such condition that the future results will be, at least, equally gratifying, and if possible to better the conditions year by year.

In this work we have endeavored to meet the need for a collection of useful information along the line of our work, which can be placed in our growers' hands, and which will, in condensed form, give information helpful in almost any problem likely to come to him in his ordinary experience.

We do not intend, in any respect, to compete with the very excellent literature issued from our State Agricultural Experiment Station, but to condense and combine the information, in most cases obtained from these bulletins, for more convenient reference in any emergency.

We are greatly indebted to this branch of the College of Agriculture, not only for the able treatises on the various insect and plant matters, from which we have obtained much of the data for this work, but also for copies of their illustrations which they have so kindly provided for us; and for assistance in the same way, our State Horticultural Commissioner's office is entitled to our earnest expressions of appreciation.

We know of no publication similar to this in the State now, excepting one by Mr. O. E. Bremner, long out of print, and from which we have taken the liberty to quote in several instances.

We would like to say a word here of the work of our office in general. We have endeavored to so conduct it as to give the best possible service, first to the fruit growers of the County, for whose benefit the office was created and for whom it is maintained, also to benefit the nurserymen who furnish trees to the growers, and those who only grow trees and plants for the gratification afforded by the sight of beautiful horticultural growth.

At times we have found it necessary, in our judgment, to insist upon a course of action not approved of by all the growers, and to which they strenuously objected, and though the task was not at all a pleasant one, we have endeavored to follow the best course for the good of all concerned, and to treat all alike without fear or favor, believing that the future will show those who felt aggrieved that this course was best. Past experience would seem to prove that this will be so, as we now encounter only a fraction of the opposition which was hurled against our work only three or four years ago. We believe the work has proved its own value in most cases, and people in general are now demanding it much more frequently than fighting it.

In the cities and towns of our County, the benefits of our work are not as apparent as among the ranches and orchards, but when we consider that much of the nursery stock planted in the orchards is sold and often grown, in the towns, where it will become infested if the town trees are dirty, a different light is cast on this matter, and we must always remember that we are protecting your neighbors as well as yourselves, and in our work we are emphatically "our brother's keeper."

In the towns where our office must do most of the work found necessary in treatment of the trees, we have this season arranged to have it done by tents and other appliances owned by the County and operated by crews hired by the day or hour, and the charge made on an itemized account, of time, chemicals and tent hire actu-

ally employed in the work, no profit being allowed to anyone. We find this plan more satisfactory even if no great saving is made, as each tree owner sees just what he is paying for.

We earnestly solicit the patient forbearance of our tree owners for our mistakes, for we shall make some, and their co-operation in the work, attempted entirely for their benefit, and from which we shall exclude in every way possible, any suspicion of contributing to private gain at the expense of public good.

We are trying to keep a very close watch on all incoming transfers of trees and plants which might, by infestation or disease, tend to make worse the condition of those of any district, and owing to the size of the County and diversity of plant troubles in different parts, we have deemed it best to supervise plant movement even within the County, and inspect the goods carefully in every case. This work faithfully done, in connection with the careful inspection by the State Quarantine Officers, of all nursery stock coming into the State, should give us the best possible security from the introduction of new troubles for the grower.

In considering the best way to arrange the things we wish to say in the following pages, we have decided to divide them into three parts, viz:

First: Treatment of the more successfully grown fruit and ornamental trees and plants of our County, and the insect pests and diseases usually found troubling them.

Second: These pests and diseases, and how best treated.

Third: How to prepare the materials and carry on the work of extermination and cure.

Many things we shall say are well known to our older country residents, but the "new comer" and the town dweller should also be considered, and some one will find in each statement just the thing he wanted to know.

The Various Kinds of Fruit and Nut Trees and Shrubs, Their Insect Pests and Diseases.

The Apple

The apple can be grown almost anywhere in this County with but few exceptions. The best is grown in the higher altitudes where there is something of a winter climate, as in the mountain districts. We also find in the level valleys, lands where the soil naturally is moist enough to grow them without irrigation. There are some varieties which grow to perfection in these sections; Fall Pippin, White Winter Pearmain, White Bellflower, Maiden Blush, Famous or Snow Apple, Banana Apple, Missouri Pippin, Red Astrican, and all of the Crab varieties grow well and are very prolific, often so much so as to need thinning out.

We find here, like everywhere else, that the apple has numerous pests: Codling Moth, Woolly Aphis, and near the coast, Mildew. These are the most serious.

San Jose Scale, the worst pest we have had to contend with in the past, is no longer a pest, being controlled effectively by parasites. In some regions like the district north of the mountains, very few insect pests of any kind are known, and all of the above pests can be controlled cheaply by modern methods.

The Apricot

The Apricot is very easily grown, but fruits best on loose soils, and at an altitude of about 200 feet and over, and nowhere are its crops as certain as the peach. Owing to its uncertainty, the fruit is more valuable.

Insect pests attacking the Apricot are: Black Scale; Brown Apricot Scale; Frosted Scale; and Greedy Scale.

The Almond

The Almond, though thrifty and easily grown, does not produce well south of the Sierra Madres. Its very early blooming time, while making it very attractive and ornamental, causes exposure of the setting fruit to the late cold of spring, with disastrous results. It is, however, grown quite extensively in the Antelope Valley and vicinity. Insects attacking it are: Deciduous Red Spider; San Jose Scale; and Greedy Scale.

The Avocado

The Avocado or alligator pear grows well in localities fairly free from frost, and at present there is good market for the fruit. The demand, however, is limited, and even at much reduced prices the assimilation of a considerable production would be very uncertain, in our opinion.

Greedy Scale and Hemispherical Scale work on the trees, but it is quite free from any other insect pests, although subject to brown fungus rust.

Berries

Blackberries and Loganberries thrive everywhere in this County if kept free from insects. Raspberries are more particular as to location, but many are grown.

Pests attacking above are: White Rose Scale; Black Scale; Red Scale; Flat Headed Borers.

Strawberries given proper culture thrive nearly everywhere if the soil is not too heavy.

Pests attacking them are: Fullers Rose Beetle; Strawberry Crown Borer. They are also subject to a fungus on leaves and stems.

Gooseberries are not as thrifty as farther north, but can be grown very satisfactorily if given reasonable care. The only insect pests attacking them is a little Greedy Scale.

Currants bear only in the high altitudes where there is frost and snow.

Bananas

These plants thrive well until cut by frost. But very little fruit is ripened, and that of an inferior quality.

Insect pests attacking it are Greedy Scale and sometimes Mealy Bug, but neither affect the plant much.

Chestnuts

The chestnut grows well in the sandy soil of the lower country. Insect pests attacking it are Greedy and San Jose Scale.

Figs

Figs are very easily grown everywhere south of the Sierra Madres, and the fruiting qualities are determined by the varieties. A little Greedy Scale and occasionally a few Mealy Bugs are commonly the only insect pests attacking figs, but a foliage blight, probably of fungus origin, sometimes affects them for which Bordeaux Mixture is probably the best remedy, and that is not very effective.

Grapes

The grape is probably the most natural fruit grown in Southern California. It thrives well in almost all kinds of soil, our annual rainfall being sufficient to mature good crops without irrigation. Of the varieties grown, wine grapes predominate. All kinds of table grapes do well in this County provided there is proper selection of soil and locality such as the different kinds thrive best in.

Phylloxera, the most dreaded grape vine pest, has never made its appearance in this County, and every precaution is being taken to keep it out.

The obscure Anaheim grape disease, which destroyed most of the vineyards in this part of the State twenty-five years ago, seems to have worn itself out, as it never has occurred in a virulent form since. Only an occasional vine may be seen affected with this disease. Great care should be used that no infestation of this kind gets to either new or old vines.

We find that most of the table grapes are very susceptible to mildew. This is always overcome by dusting with sulphur at blooming time and again when the grapes are one-quarter grown. Thorough dusting the first time makes less work the second time. Grapes on a home place in the city or elsewhere, that do not bear well, can almost always be made productive by proper sulphuring..

Guavas

This peculiar sub-tropic fruit, ripening at the beginning of winter, is grown with surprising ease in localities free enough from frost for the fruit to mature. Insect pests attacking this fruit

are very few and practically of no importance, and I know of no disease affecting the trees, but in planting, a good variety should be selected.

Grapefruit

See Pomelo and under Lemons.

Lemons

The lemon, with the orange, the grapefruit and the lime, and a few other unimportant members of the citrus family are subject to far more insect pests and diseases than any other crop, trees or plants of the County. These trees all grow thriftily where reasonable moisture is supplied, even in quite frosty location, not however in the frost conditions prevailing north of the mountains. But profitable fruit production does not always accompany thrifty growth.

In considering a citrus grove investment, the following conditions must absolutely be present for success. They are, a good soil, plentiful water supply at reasonable cost, and reasonable freedom from frost and wind. These secured, and good trees free from insects or disease planted, and the grower is ready to begin the fight, which will last as long as he has trees, against insect pests and disease.

These might be enumerated as follows: Black Scale; Red Scale; Yellow Scale; Oleander Scale; Soft Brown Scale; Hemispherical Scale; Purple Scale; Citrus Mealy Bug; Longtailed Mealy Bug; Citrus Red Spider; Silver Mite; Citrus Thrips; with several other pests watching an opening to invade our State and causing us an expense of thousands of dollars each year to keep them out; but in spite of all these drawbacks, intelligent and industrious growers have realized surprising profits from lemons, oranges and grapefruit in the last twenty-five years.

In addition to the above troubles, tree diseases must be watched for: Gum Disease; Wither-tip; Die-back; Lack of nourishment (Chlorosis) and several other diseases of less importance.

The lemon crop is injured also by the brown rot, and more than the other citrus fruits by the unexpected frosts, yet Los Angeles County shipped last year 1,200,000 boxes of lemons, 2,790,000 boxes of oranges, 18,900 boxes of grapefruit, at least three-fourths of them all, marketed at an excellent profit.

Loquats

This tree grows as thrifty as a eucalyptus anywhere south of the mountains, and will stand more frost than an orange. The fruit ripening in the winter is always welcome, though of comparatively little value, owing to the large seed. Some varieties however bear larger fruit with thicker meat, but more acid flavor.

The Greedy Scale and occasionally the mealy bugs are the insect pests that attack the loquat, and the scaling bark seems to protect the tree from much injury by them.

Mulberry

The ordinary mulberry is as thrifty and hardy as an oak here, where it can obtain sufficient moisture, and for silk worm culture, would probably be the tree to grow, but the fruit is of little value; and there are two varieties at least of smaller habit of growth which produce large luscious fruit somewhat later in the season, which we would recommend in most cases, though the fruit being very soft would be difficult to transport. They will attract the birds and thus protect fruit of more value, ripening at the same time.

A little Greedy, Black and Red Scale are occasionally found attacking this tree.

Nectarine

The nectarine is very easily grown everywhere in this County, and is infested with about the same pests as the peach, but seems especially subject to injury by the Black Peach Aphis.

Orange

See under Lemon. It is more subject to black scale than the lemon.

Olive

The Olive, though grown with little trouble anywhere south of the mountains, is profitably productive in only a few locations having granite soil, freedom from frosts and fog, and having hot summers. It is the general opinion throughout the County that an olive grove is a poor investment. Some varieties, however, in good localities are yielding fair returns, especially with the improved prices of the last few years. The trees should never be planted near citrus trees as they are great breeders of Black Scale and are also attacked by Hederae and Greedy Scale.

Pomelo (Grapefruit)

The pomelo, though a thrifty grower and free bearer, not more liable to frost injury than the orange, is particularly liable to attacks of Black Scale and Mealy Bug. Yearly fumigation is almost a necessity. It is fairly profitable when grown under right conditions. (See also under Lemons.)

Peach

Very easily grown and a prolific bearer all over the County, no yellows or rosette known, mildly subject to attacks of Greedy and San Jose Scale, also Green Aphis and the Black Peach Aphis (*Aphis persicae niger*) which latter is somewhat menacing where it has been introduced. Peach root borer and peach twig borer also do some injury; a fungus disease known as curl leaf has to be combatted. Some varieties are quite free from it, however, and spraying with Bordeaux Mixture soon after the leaves fall and perhaps in spring controls it well.

Pears

The pear tree grows thriftily anywhere in the County and if kept free from insects and with sufficient moisture, bears well. It has been much neglected, owing to the pear blight, in latter years south of the mountains, but produces excellent profits to quite a number of growers on the north slopes, and in the Antelope Valley region. It is quite subject to the deciduous Red Spider, the Greedy Scale and the San Jose Scale, and in some localities has been greatly injured by the Pear Blight, which, however, is well controlled by Bordeaux Mixture and Lime-Sulphur spray.

Plum

This is perhaps the most productive and healthy fruit tree grown in our County and the freest from insect troubles. It fruits well everywhere, though some varieties are better in this respect than others, and a little Greedy, Black and San Jose Scale, usually unimportant, are about all the insects found on it.

Prune

This tree, planted to a considerable extent here in former years, has more lately been much neglected, as in this locality we can not seem to produce fruit equal to counties further north, and the low markets do not warrant growing of inferior fruit.

Insect pests attacking it are about the same as for the plum.

Pomegranate

A fruit of little market value, and not much valued by most people. It is easily grown and troubled a little by Greedy Scale only. As a novelty is desirable for domestic planting.

Persimmon

Very easily grown and little affected by insects. The variety yielding large fruit is desirable for home use.

Quince

This delicious preserving fruit no one in the County need be without as it will grow itself with little care when once set out. Pests attacking it are Black and Greedy Scale, and the Pear Slug sometimes does damage.

Walnut

A valuable tree for Los Angeles County south of the Sierra Madres, where frost is not too severe. It thrives best in a moist alluvial soil, though some good trees are growing in quite heavy soils. It does not do well in the dry granite soils of the foothills where irrigation supplies the only moisture in the summer. A permanently moist subsoil within reach of the roots produces the best trees and crops.

Some Greedy and Walnut Scale may be found on this tree, but the only thing causing the grower much concern is the Walnut Blight, which has almost ruined many groves and is probably present to an injurious degree in all of them. Resistant varieties are being developed and grafted stock produced, which it is confidently hoped will produce blight proof groves in the future. The walnut tree is also attacked by a walnut aphid which smuts the leaves and fruit very badly some seasons. It is held in check very largely by the larva of the common lady-birds. A good walnut grove is a good investment.

Celery

This vegetable has been grown successfully on all light, fine sediment soil in the County, and while not generally competing with the far famed Orange County peat beds, is a profitable garden crop, and we have some localities which will compare well with the best.

Its principal disease is the late blight which affects the lower leaves first, but later spreads well over the plant, leaving its dark stains on stalks and preventing the development of the whole plant. The remedy for this is Bordeaux Mixture applied twice while the plants are in the seed bed, again about five weeks after they are set in the field, and once a month thereafter until the rains come. After that, often enough to keep the leaves well covered, but at least once in two weeks to protect the new leaves constantly pushing up, until harvested. Many growers consider the expense of this repeated spraying not justified by the injury usually caused by the blight.

Asparagus

A wonderfully profitable crop in some localities, but these "right" localities do not seem plentiful. The rust has caused anxiety the past few years. It attacks the bushy after growth, checking the vitality of the plant. No wild asparagus should be allowed to grow in cutting time. Irrigate and cut well in summer and fall. After cutting dust tops thoroughly with dry sulphur, and repeat two or three times later in the season. Always plant seed from non-rusting plants.

Alfalfa

Our wonderful forage plant has always been very free from insects except the army worm which eats everything, and a locust which would sometimes eat the foliage of a crop in some localities. But it is now threatened with the alfalfa weevil from Utah, which is making great havoc with the alfalfa fields there. Give the State or County Horticultural Commissioner **immediate** notice of discovery of any bug or worm which resembles it. We want to run down every suspicious case. It will be done at State expense and will cost you nothing.

The Dodder, a parasitic plant, has been a serious pest in many fields and the seed and plant should be carefully guarded against. The plant should be destroyed at once when found.

THE MORE COMMON SHADE AND ORNAMENTAL TREES AND PLANTS LIABLE TO INSECT INFESTATION

The Pepper

This beautiful tree is unfortunately a very persistent Black Scale breeder in many localities where other black scale infested trees are near it, and its size makes its treatment difficult. Spraying, the only practical method, seems very ineffectual, and probably the best course with larger trees, is to defoliate them by trimming off all branches under two inches in diameter. If this is done late in the fall or early in the winter when shade is not required, the new shoots will produce the shade again by the following summer, and the scale will be completely destroyed, for the time at least.

The Black Acacia

The above name, while not scientifically correct for the Black Wattle (*acacia melanoxylon*), is the one commonly used here. (Black Wood is better.) Oleander Scale and Greedy Scale are the important insect enemies of this fine shade tree, and both are easily controlled by a good emulsion spray. Cottony Cushion Scale (*Icerya purchasi*), though often getting started on this tree, is soon completely controlled by its lady-bird enemy (*Novius cardinalis*) and a chalcid parasite (*Lestophonus iceryae*), and need no attention.

The Camphor

This most beautiful dwarf street and ornamental tree, while easily grown and very hardy as to injury, has some serious insect and disease enemies. The Red Scale will kill it sometimes if not checked. The Greedy Scale has a love for it, and a peculiar blight of the tender new growth and sometimes of the older leaves checks its thrift and often makes it quite unsightly for a time. The former must be controlled by sprays and the latter is a problem as yet unsolved.

The Sterculia or Bottle Tree

Very easily grown and free from pests and disease except the Greedy Scale, which often becomes quite thick on the bark, to the decided injury of the tree.

The Palms

Some varieties of these trees, so universally hardy in California, and which fill so large a place in our list of trees, are very free from insect pests. Of this description are the large fan palm and some kinds of the date palm. On those infested, the scale is easily seen along the troughs of the leaves and on the *Coccus plumosus* and a few similar sorts on the stalk at the base of the leaves. The kinds of scale are the Oleander (*Aspidiotus hederae*), the Greedy and the Red Scale.

One tree classed with the palms, the *Dracaena*, often called the Yucca Palm, is always likely to be infested with Long-tailed Mealy Bugs, in fact it is one of the worst breeders of this insect and the hardest to rid of it. The Sago Palm almost always harbors more or less Black Scale.

Umbrella Tree

Easily grown, but quite subject to Greedy Scale, to an extent which often injures it badly.

Rice Paper or Rice Tree

Easily grown, somewhat subject to Mealy Bug of both kinds.

Magnolia

A beautiful thrifty tree if watered, subject somewhat to Greedy Scale and Mealy Bugs. Will grow anywhere south of the mountains.

Cypress (all varieties)

Subject to a Mealy Bug of a kind seldom found on other trees, but nearly resembling the citrus variety. It is pretty well controlled by a parasite. The tree is very thrifty and hardy.

Norfolk Island Pine

Araucaria excelsa

Beautiful and thrifty if watered. Very subject to a pure white oval scale peculiar to this tree, called *Eriococcus araucariae*; fairly easy to kill with resin wash.

Araucaria Bidwelli (Monkey Puzzle)

Very thrifty with water, and subject to a comparatively rare scale, similar to Greedy Scale in shape but darker, called *Aspidiotus rossi*. Resin wash will kill it.

Oleander

Easily grown, beautiful but poisonous, even in odor, and a great Black Scale breeder. Also has Greedy and Ivy Scale. Very difficult to keep clean.

Castor Bean

This plant should never be allowed to become two years old, as the Red Scale then begins to breed on it, and it will soon almost completely cover the smaller branches and thus be communicated to other trees and plants of value.

The Roses

Many kinds of roses are very clean from insects, while others growing beside them are covered with Red and Greedy Scale, and are very difficult to clean. The Rose Scale (*Aulecaspis rosae*) is very apt to appear on the older canes near the root, working thence upward, and Black Scale sometimes gets started on them also.

The Lauristina

A very thrifty and beautiful ornamental shrub, but very subject to black and other scales.

Euonymous (A variegated leaf shrub)

Very thrifty and easily grown, but quite subject to Black Scale, Greedy Scale and Mealy Bug.

Nightshade

Very subject to several kinds of scale, Black, Red, Greedy, etc. Should be destroyed everywhere, and especially should never be allowed to grow in or near an orchard.

Wistaria

No trouble to grow when once established, though a little slow in starting, whether set out or raised from seed. In the latter case it seldom blooms until grafted. It is very subject to Mealy Bugs if any are about. Also sometimes has a little wistaria scale.

Climbing Potato

A vigorous rapid growing light climber, but sure to be troubled with Black and Ivy Scale, and very likely Mealy Bug.

Australian Sweet Pea

A very strong rapid grower and thick and persistent, but sure soon to be attacked by Black and Ivy Scale and Mealy Bug.

English Ivy

Easily grown and beautiful, but pretty sure to suffer from Ivy Scale.

Ferns

Many kinds of ferns are attacked by the Hemispherical Scale, and as the adults are almost proof against sprays, the affected stalks should be cut out, and as the young scale appear, spray well and repeatedly with kerosene emulsion. The potted and bedded ferns suffer alike with this scale.

Umbrella Plants

(*Cyclurus alternifolia*)

This plant is a prolific breeder of Mealy Bug, and should be very carefully watched if grown.

Papyrus

Very liable to have Mealy Bug in the tops.

Grevillea

A thrifty tree, hardy to a temperature of 15° with reasonable moisture. Large, showy, yellow bloom. Constant dropping of the large leaves is often very annoying about dwellings and is an objection to the tree. Mealy Bugs, Black and Greedy Scale infest them to some extent. Distillate emulsion is recommended.

The Privet

(*Ligustrum*)

A small, pretty hardy, street and ornamental tree near the coast, having only a little Ivy Scale as insect pest.

The Jacaranda

This easily grown novelty with its fern like leaves has a little Black Scale with which to contend.

The Pittosporum

This hardy and much admired ornamental tree is much troubled with Black and Greedy Scale. Frequent spraying with distillate emulsion will be required to keep it clean.

The Eucalyptus

This tree has to a reasonable degree met the needs of the southwest for a timber supply, and some variety can be found which will just be suited to almost any locality and any requirement of a tree in our County. However, there are many varieties of them, and they differ so much that the consideration of a few of the best in this book, will not be amiss. It is believed that in the future the requirements of this state for hardwood lumber will be much more fully met than has yet been done by the eucalyptus. The eucalyptus is attacked by very few insect pests or diseases, though on the seed pods and young shoots of the globulus or Blue Gum, we sometimes find some Greedy Scale, and a root trouble shows at times, especially in very damp locations.

Eucalyptus globulus (Blue Gum), the most grown tree in Southern California, is of wonderfully rapid growth, and this fact makes the hardness and heavy weight of the timber the more surprising. The timber is not, however, durable in the ground, hence is not suitable for fence posts, telegraph poles or railroad ties, though it is said to make very satisfactory piles for use in salt water, and to resist well the action of the toredo and other destructive ocean insects. To raise for fuel it is one of the best trees for this County, and if the tendency to check and warp can be obviated, it can be adapted to wagon manufacture and similar use; however, if exposed to the air and weather unpainted, it becomes brittle in a few months. It makes a good wind break, and for foresting our otherwise useless foothills, it is among the best trees known. If these hills could be planted and fire kept out, they would soon be clothed with a valuable gum forest.

Eucalyptus tereticornus (Forest Red Gum or Gray Gum) is one of the best to raise for timber. Durable in the ground, hard, strong, good grain, well suited to any purpose. Posts of this wood are reported to have stood in the ground in good condition for 55 years in Australia. These trees grow about two-thirds as fast as the Blue Gum, and are probably the best suited to all conditions of our County of any eucalyptus, standing cold down to 20° and doing well on the desert. They thrive well on the foothills and the bloom yields abundance of honey for bees.

Eucalyptus rostrata (Red Gum) is a similar timber to *tereticornus*, a little slower growth and not as straight, will stand cold to 20° and is a harder, finer grained wood. It is very durable in the

ground and salt water, fine for inside finish and furniture work, grows well on the foothills, on the desert or in alkali; blooms furnish good bee food. It is one of the most desirable of the eucalyptus.

Eucalyptus viminalis (Manna Gum) is a quick growing tree, is hardy as to frost, heat and drouth as any eucalyptus, and makes a very big tree. It is excellent for a wind break and for foothill planting, but poor timber, not as good as the Blue Gum.

Eucalyptus rudis (Desert Gum) is one of the best for extremes of both heat and cold, but it requires a fair amount of moisture. It makes a good wind break, yields good honey, and the wood lasts well in the ground. Presumably the wood is hard and serviceable.

Eucalyptus corynocalyx (Sugar Gum) is a fairly rapid grower and yields a good supply of bee food. Very hardy in all locations except the most frosty, seeming to stand the heat and drouth well. The timber is very durable in the ground, and for wagon and similar construction work, and does not warp badly.

Eucalyptus robusta (Swamp Mahogany) is a very handsome street tree while young, but becomes more straggling after the fifth year; of fairly rapid growth, very tolerant of alkali but not of drouth, and with timber very durable in the ground but not very strong. Trees are apt to break with the wind.

Eucalyptus sideroxylon (Red Ironbark) is a dark, rough barked tree, large but not high, unsuited to hot interior valleys; a nicely shaped shade tree, and a good forest cover for stony sterile land, but of slow growth. Good timber for all ordinary uses.

Eucalyptus diversicolor (Karri tree) is a very large stately tree, and in Australia reaches 400 feet in height and 20 feet in diameter. It requires some moisture and is not a desert tree, but stands cold to 20°. Growth is fairly rapid, and timber straight grained, which is rather unusual in Eucalyptus. It is valuable for lumber and wagon work.

Eucalyptus polyanthema (Red Box) grows to a medium size and is of fairly rapid growth. It thrives well and is very hardy in all locations. The timber is very hard, strong and durable for railroad ties and wagon work, and it makes fine fuel. It has a spreading habit of growth and makes a fine shade tree, also a good street or roadside tree.

Eucalyptus populifolia (Poplar-leaved Box) is of medium size, much resembles *polyanthema* and is more tolerant of desert conditions.

Eucalyptus occidentalis (Flat-topped Yate) is a slow growing variety of more spreading habit than most eucalyptus. Does well everywhere if not too frosty. Should make a good street tree; timber is good and durable.

Eucalyptus ficifolia (The Crimson-flowered Gum) is of slow growth, slender drooping branches, flowers bright crimson if variety is not mixed with others; a very handsome street and ornamental tree, but as the wood is tender, must be kept cut back to prevent breaking and a misshapen top. It is intolerant of frost.

Eucalyptus citriodora (Lemon-scented Gum) is a fairly fast growing tree of upright habit and furnishing excellent timber for any purpose, it is similar to hickory, will not stand much frost or drouth. Its leaves smell like the lemon.

For the data regarding the qualities of the different varieties of the eucalyptus we have drawn largely from the writings of James A. McClatchie.

HARMFUL INSECTS AND THEIR CONTROL

To act intelligently in the control of insect plant pests, we must remember that they are divided into two general classes, according to their habits of attack on the plant.

The sucking insects, including the scales, spiders, mites, plant lice, squash bugs, etc., obtain their food by inserting their proboscis into the tissues of the plants and extracting the sap, causing insufficient nourishment to the plant leaves, shown by pale or drooping foliage.

The biting insects have jaws similar to ours, but which work sideways, and they take portions of the masticated leaves and other plant tissues directly into their stomachs, often defoliating portions of the trees and tunnelling the bark and even the wood. They include the grasshoppers, leaf-eating beetles, and the many forms of moth, beetle and butterfly larva, known as cut-worms, grubs, wireworms and caterpillars.

The biting insects can be poisoned either by arsenical sprays (Paris Green or Arsenate of Lead) put on the foliage of the plants, or by similar poisons in tempting food, like dampened bran, or some kind of green food placed near their haunts.

The sucking variety can be killed either with sprays, which kill by coming in contact with their bodies, or poisoning the air about them, or smothering them by closing up their breathing places, usually a row of holes along their sides, called spiracles.

The kerosene or distillate or caustic emulsions act in the first mentioned manner, fumigation the second, while resin wash closes up the spiracles.

The Black Scale (*Saissetia oleae*)

The Black Scale (*Saissetia oleae*) is probably the most widely known and constantly fought of any scale of the citrus tree, and is usually pretty well known in the adult stage. It is black, or nearly so, and has cross ridges on its back in the form of the letter H, by which it can easily be distinguished from the Hemispherical and other scales of the same family.



Black Scale, and Lady-bird Larvae (*Saissetia oleae*) Adult.

The young are hatched but once a year usually, from about July 1st to September 1st, though where the hatch has not been controlled by fumigation, off hatches often occur at other seasons. Some hatch as early as April and May, and in this case they have time to mature and a second hatch occurs, making two broods in the one year. The young are, at first, so small as to be seen with difficulty, are pale yellow and move quite freely but slowly on the twigs and leaves of the host plant. In a few days they force their proboscis through the outer skin of the leaves or bark and begin to live on the sap, seldom moving until about three or four months old, when they crawl back to the last growth of young wood, seal themselves fast, remain until matured, when they begin to deposit eggs. It is difficult to say just how long it takes to deposit all the eggs, also how long the eggs remain dormant, as weather conditions control this scale through all its stages.

They begin to turn darker as soon as hatched and they crawl from under the shell. A tough skin begins to form over the back at once, getting thicker and darker as the insect grows. During the first two months it is so flat and so near the color of the dust covered leaves that many persons fail to notice it at all, or if they

do notice it, fail to recognize it as black scale. In five months it is about as large as the adult in diameter, but quite flat, a dull blue in color, and from this time on it is quite difficult to kill with the best of fumigation, until when full of eggs it becomes almost impossible to kill it by a dose the tree will stand, the shell being very hard and impervious to gas or spray. It is sealed so tight to the tree that no gas can penetrate it.

When the mother deposits her eggs, her body arches over them, decreasing in size as the number of eggs increase, until when the eggs are all deposited to the number of 750 or more, the insect soon dies, and in about four or five months the hatching begins.

There is one efficient parasite of this scale, a small black fly, *Scutellista cyanea*, often called "Scutes," which deposits one or more eggs under the scale. These hatch before the scale eggs do, and the resulting larvae lives and grows on an egg diet, often consuming all the eggs before it pupates. After going through the pupa stage, the mature fly pierces the top of the scale shell and crawls out. The old scale shells showing holes in the top are only empty houses where the parasites have done their work and gone. This largely occurs before the fumigation season begins, and the remaining larva still in the shells are seldom killed by the gas as I have myself observed. The objection to fumigation, that the parasite is killed as well as the scale is therefore unfounded as to the larva.

The list of plants and trees harboring Black Scale is very long, the more common ones include the citrus trees, the pepper, olive, oleander and apricot, and the wild night shade weed, which last should never be allowed to grow in or near orchards as an added breeder of the Black Scale.

The black smut on the leaves of trees infested with this pest is caused by a black fungus which grows in the honey dew, an excretion thrown out by the scale and greatly relished by the ants who always come after it, but who, instead of injuring the scale, probably help to spread it.

Fumigation beginning at the completion of the hatch and continued to the blue stage is the only reliable remedy for Black Scale, though when they are all very young, the kerosene or distillate emulsion sprayed as strong as the tree will bear, will check them. But owing to the thick foliage of citrus trees, some scale always escape the spray, soon to make the trees as bad as ever. On deciduous trees, after the leaves fall, carrying many scale with them, spraying results are much more satisfactory.

Soft Brown Scale
(*Coccus hesperidum*)

This scale, for the first month of its life, looks very much like its black cousin, only a little longer and a trifle lighter in color and more waxy looking, and at this stage they are so transparent that the legs of the insect can be quite plainly seen through its body. Often, however, it shows dark spots beneath its skin, and until



Soft Brown Scale (*Coccus hesperidum*)

the outer skin becomes thick and a solid brown in color, these dark spots and streaks show through, making a distinguishing mark. There may be three or four generations in a year.

The young are born alive and act and feed very similar to the Black Scale, except that they do not travel far before settling down for life. The individuals are thus very close together, and they have the sticky repulsive appearance mentioned above. At the present time infestations of this scale soon disappear owing to effective work of several parasitic flies, whose dark colored larva within cause the dark spots and streaks seen through the skin. Were it not for these active parasites, this scale would probably be one of the worst pests of our citrus groves.



Hemispherical Scale (*Saissetia hemisphaerica*) A enlarged individual.

Hemispherical Scale (*Saissetia hemisphaerica*)

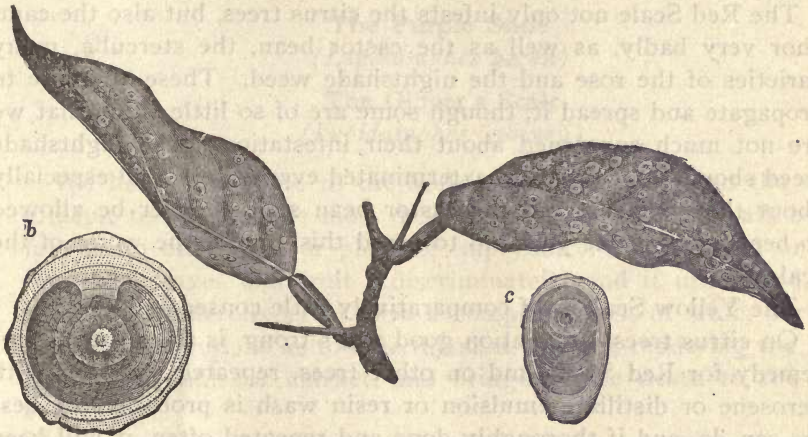
This scale somewhat resembles the Soft Brown Scale, but is more elevated, nearer circular at the base, and hard and shining on the top. The color is a bright brown which is assumed while they are quite small. They infest ferns principally, but sometimes other ornamental plants and trees, and occasionally citrus trees, settling on leaves as well as branches. The adults are hard to kill, but when young are readily killed by fumigation and thorough spraying. Good results by spraying depend upon the thoroughness of the work.

The Red Scale
(*Chrysomphalus aurantii*)

The Yellow Scale
(*Chrysomphalus aurantii* var. *citrinus*)

The Red Scale is in many respects a very different insect from those we have already mentioned. The adult is about the diameter of a pin head, nearly circular, and varies from gray to brick-red, in color. The form on top rises gradually from the edge towards the center, which is marked by a more or less distinctive pyramid or nipple. It is well protected, with an armored shell above and a tight film underneath making it very hard to kill by fumigation.

The young are produced alive, not hatching from eggs, and at all seasons of the year, though much more numerous in the warm weather.



Red Scale (*C. aurantii*) (a) natural size of leaf; (b) female scale greatly enlarged; (c) male scale greatly enlarged.

In treating trees for its control, the best time is during the summer or fall months when there is the largest proportion of young, but good fumigation will bring results at any time, as there is never a period when all the scale are resistant to the gas. However, this is always a hard scale to eradicate entirely, and the best time for fumigation is none too good, some practical men having stated the Red Scale is as hard to kill as the Purple Scale.

The Yellow Scale is so similar to the Red Scale that each is often mistaken for the other, and the following are some of the differences by which they may be distinguished. The Yellow Scale is much more easily killed than the Red. It is a trifle broader,

thinner and lighter in color. When crushed it will not pop like the red or produce much moisture, and it is less regular in shape. It is found on the fruit, the leaves, or more tender new growth, scarcely ever on the wood, while the Red seldom settles on a leaf, practically always on the branches and fruit. The Yellow is much more easily affected by the gas than the Red, and there are other differences revealed by the microscope which establish the fact that the varieties are distinct, but which are of little practical value to the grower.

Many of both of these scales always find lodgment on the fruit of infested trees, and as the Red especially is very difficult to wash off completely, the sale of the fruit is greatly injured. A depression seems often to form under a Red Scale which will remain after the insect is removed, and the lemon, which seems more attractive to them than the orange, is also more apt to be pitted.

The Red Scale not only infests the citrus trees, but also the camphor very badly, as well as the castor bean, the sterculia, many varieties of the rose and the nightshade weed. These all serve to propagate and spread it, though some are of so little value that we are not much concerned about their infestation. The nightshade weed should be fought and exterminated everywhere, and especially about the orchards, and the castor bean should never be allowed to become over one year old to breed this, one of the worst of the scales.

The Yellow Scale is of comparatively little consequence.

On citrus trees, fumigation good and strong, is the only efficient remedy for Red Scale, and on other trees, repeated spraying with kerosene or distillate emulsion or resin wash is probably the best we can do, and if thoroughly done and repeated often, it will keep the trees in very good shape.

The Greedy Scale

(*Aspidiotus (rapax) camelliae*)

The Ivy Scale

(*Aspidiotus hederae*)

These two scales are in shape much like the Red and Yellow Scales, but in color are a dirty gray, and are often mistaken by the uninformed for a fly speck when they appear on a leaf.

Like the Red and Yellow Scale, one of these scales, the Greedy, usually infests the twigs and branches of the trees, the other the leaves or very young and tender shoots. The Greedy Scale is also

quite apt to crowd very closely together, often over-lapping, while the hederæ are almost always separate. The latter is the one which usually infests English Ivy and the climbing vines and soft juicy plants, and also the Palms, which often have them very badly. The Greedy attacks perhaps the greatest variety of plants and trees of any scale, hence its name, and to many it is very destructive.

Among trees, we find it on all the deciduous fruit trees more or less, the umbrella often very bad, sterculia, acacias, pepper, camphor, citrus, loquats and some kinds of grapes. In fact you are likely to find it on almost any plant that grows if it is bred freely by some plant or tree in the neighborhood.

These scales are not very difficult to kill, and a good kerosene or distillate emulsion will get them if well applied and often enough, at any time of the year.

The Purple Scale

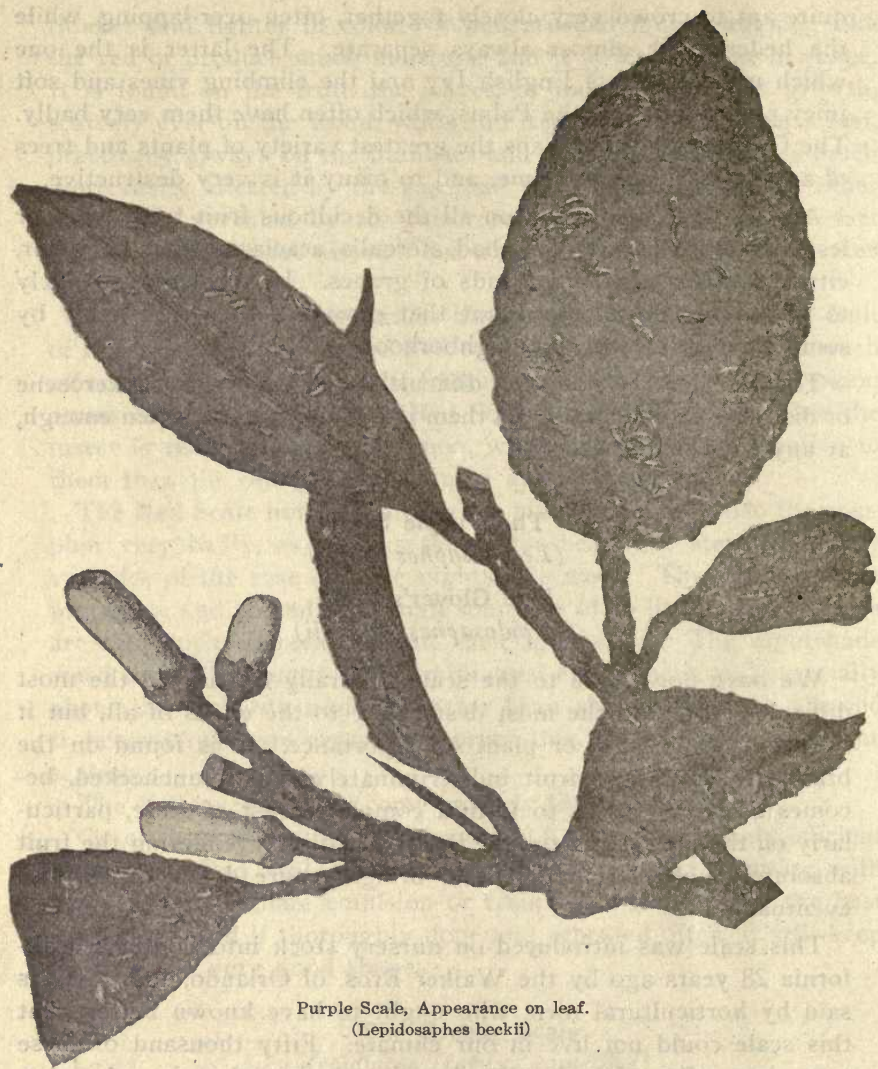
(*Lepidosaphes beckii*)

The Glover's Scale

(*Lepidosaphes gloverii*)

We have now come to the scale generally considered the most difficult to kill and the most destructive to the citrus of all, but it infests no other tree or plant of importance. It is found on the branches, leaves and fruit indiscriminately, and if unchecked, becomes so numerous as to form a complete crust of scale, particularly on the fruit, so as to hide the skin entirely, rendering the fruit absolutely unfit for market, and bringing sure death to the tree eventually.

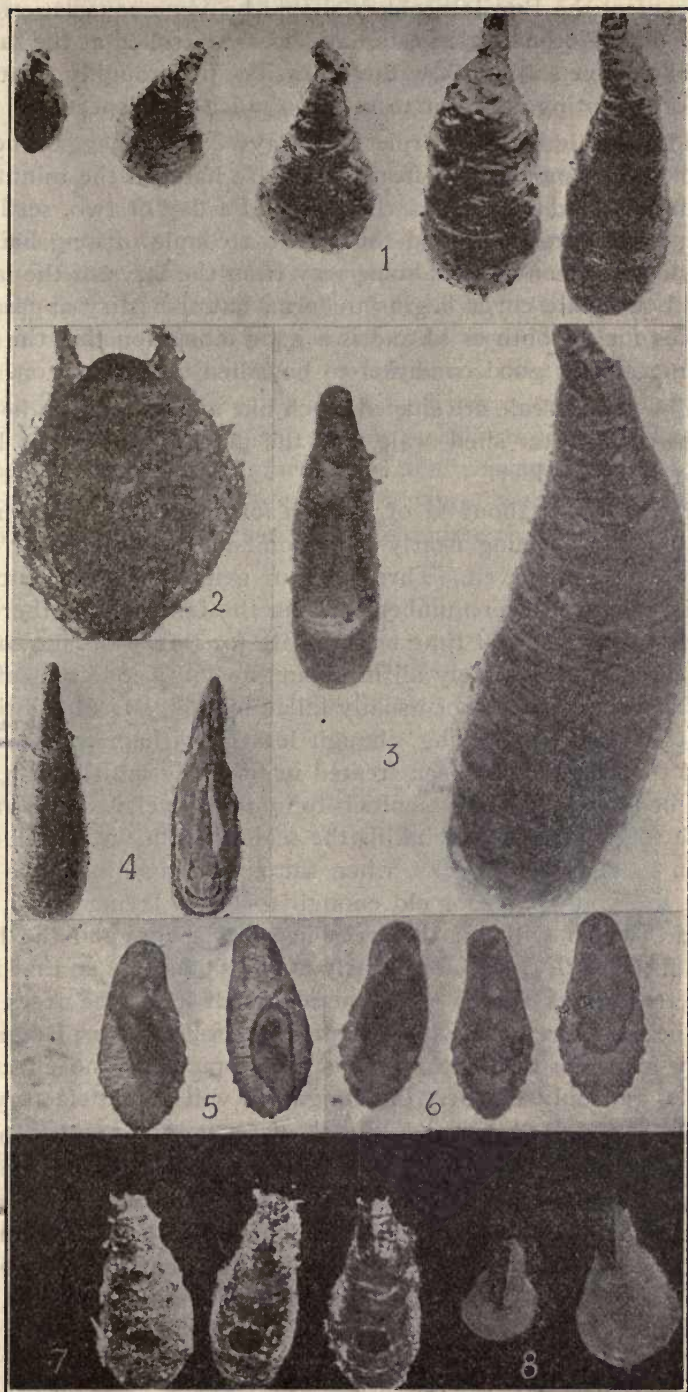
This scale was introduced on nursery stock into Southern California 28 years ago by the Walker Bros. of Orlando, Fla. It was said by horticultural men, who ought to have known better, that this scale could not live in our climate. Fifty thousand of these trees were allowed to be distributed and planted in Los Angeles, Riverside and Orange counties. The greater part of them were planted in Riverside after being thoroughly dipped in resin wash. If any Purple Scale survived this treatment the writer has never heard of it. The greater part of these trees that were planted about Downey, Rivera and Whittier were not treated, consequently in two years the trees had become badly infested and the scale had spread to the older orchards. This was before the sheet tents came into use, and the method of fumigating large trees at that time was



Purple Scale, Appearance on leaf.
(*Lepidosaphes beckii*)

so expensive as to make the cost prohibitive. Very little effort was made to control the scale until 1902. Consequently there were eighteen years during which it was allowed to spread, and all citrus trees from Downey north to Pico and east of the Old San Gabriel River for 20 miles had become more or less infested with it.

In the past 10 years nearly all citrus trees about Whittier, Rivera and Downey have been fumigated each year with very good results, and while the growers have kept up a persistent and costly fight



Purple Scale. 1. Development of scale covering. 2. The beginning of the scale covering. 3. Male and female scales, showing comparative size and shape. 4. Dorsal and ventral view. 5. Two stages of larva of *Aspidiotiphacus citrinus* with purple scale. 6. Pupae of same within scales. 7. Exit holes of *A. citrinus*. 8. Formation of the covering after first molt.

to control the Purple Scale, it should be some consolation to know that all the other scale pests have been controlled at the same time.

The above should show the necessity of thoroughly treating trees before planting, and not to rely too much on inspection.

The female of the Purple Scale lays 25 to 30 eggs when she is about three months old from which are hatched the minute yellow youngsters who, after crawling around a day or two, settle for life like the other scales, and throw out a couple of long hairs which seem to protect them in some way from the larva of the lady-birds until the scale cover begins to form, but the hairy appearance remains for a month or so and is a good indication that the scale are young and in good condition to be killed by fumigation.

The young scale are shaped much like an oyster shell, being often known as oyster shell scale, and the pointed end grows longer as they become older.

The adult is about $\frac{1}{8}$ of an inch long and 1-16 of an inch wide in the rear, coming nearly to a point at the other end, which in the female is curved. Three or four generations are hatched in a year, but the larger number come in the fall months, therefore the early fall is the best time to fumigate for this scale, but at no time are they approximately all in about the same condition of growth, and as the eggs are not usually killed by gas, one fumigation never gives a complete killing, though lessening them to ~~some~~ ^{a great} extent, and they have often been treated in this way with benefit.

The plan giving best results is to fumigate well about from August 15th to Sept. 15th, which kills the scale then in the breathing stage, then in about ten weeks, when the eggs remaining have hatched, but the young are not old enough to begin laying eggs, fumigate again, which will put the trees in good shape, and the hatch for the future will come more nearly at the same time so that the regular treatments at the usual periods will keep the trees in good shape, and for those who can afford to follow this plan it is economy for them to do so. Sprays have practically no effect on this scale, and only the best of fumigation will be satisfactory.

The Glovers Scale belonging to the same family with the Purple Scale is of comparatively very little importance. Its appearance is very similar, but it is not so broad in the rear, is more nearly straight and not usually quite so long. We know of none in this County on citrus trees, and very little in Southern California, but on box-wood we very frequently find it. Fumigation is the best remedy.

The Citrus Mealy Bug

(*Pseudococcus citri*)

The Long-Tailed Mealy Bug

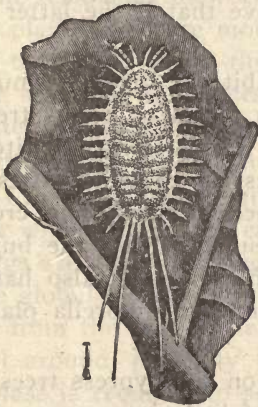
(*Pseudococcus adonidum*)

The Cypress Mealy Bug

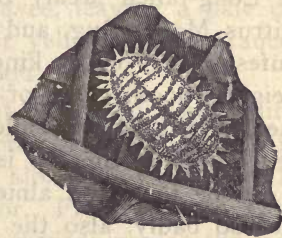
(*Pseudococcus ryani*)

The mealy bug is a pest which has seemed to spring into great importance in the past three or four years. It is a small oval shaped bug about one-eighth of an inch long at its largest, in shape much like the damp bugs or sow bugs found under boards in damp places, but white as if flour had been sprinkled all over it. The long-tailed kind have from three to five long hairs nearly parallel, protruding from the rear, the hairs being nearly as long as the bug.

In the East they are a greenhouse pest constantly fought, and here are found on a great number of plants and trees, those for which we are most concerned being of course the citrus trees.



Long Tailed Mealy Bug (*Pseudococcus adonidum*)
Much enlarged.



Citrus Mealy Bug. (*Pseudococcus citri*)
Much enlarged.

The female of the citrus mealy bug deposits 350 to 400 eggs, protecting them in a cottony substance which she secretes, and they hatch in about two or three weeks according to the temperature. There are probably four or five generations a year. The male is a two winged fly.

They infest the branches, leaves and fruit of the citrus trees, and in the latter are very often hidden in the navel, and under

the husk like collar about the stem, and in these places are almost impossible to remove or kill by sprays. If left on packed or curing fruit they continue to breed and eat and grow until the whole package is infested. Many come to our ports on pineapples from Hawaii after a voyage of some length, proving their tenacity of life.

They secrete a honey-dew, and the smut produced thereby with the masses of cottony material on the tree and fruit, have a very repulsive appearance. The growth of the tree is not materially checked unless the infestation is very bad, but the sale of the fruit is much injured, and ruined if bad, as it is impossible to clean it all, and the severe washing causes decay and loss.

The ants are sure to accompany the bugs, but as in the case of the Black Scale, they never injure them, but undoubtedly carry the young from place to place and aid in their spread.

In some localities spraying seems to have given as good results as anything, and at lower cost than fumigation, but our experience leads us to believe that fumigation is the best, all things considered. Spraying can never eradicate the insect, only control it, and if repeated as often as necessary for good results, it is as expensive as fumigation, and we believe that if the latter is persisted in, they can be eradicated.

The Long-tailed Mealy Bug has habits of life very much like the Citrus Mealy Bug, and it is often found on citrus trees, but will infest nearly every kind of plant if one of its favorites is in the neighborhood. One of the greatest of these favorites is the *Dracaena* Palm, often called the Yucca Palm. The crown of pointed leaves at the top is very often alive with the bugs, and some can be found on almost all. The magnolia also has them, but not so badly, also the papyrus and the umbrella plant, and similar ornamental plants.

The Cypress Mealy Bug lives only on the cypress trees, either in hedges or growing singly, and is of little importance comparatively.

On trees and plants other than the citrus, spraying is probably our only resource, and the distillate emulsion and the carbolic acid spray we consider the best. Each has its advocates in different localities.

The Citrus Red Spider

(*Tetranychus mytilaspidis* Riley)

The Six Spotted Red Spider

(*Tetranychus sexmaculatus* Riley)

The Almond or Deciduous Red Spider

(*Bryobia pratensis*)

The Silver Mite

(*Eriophyes oleivorus*)

These little creatures, while not belonging to the insects, but to the spider or mite family, are of great interest to the fruit grower. They are very small and difficult to detect, though the bright red color of some are in strong contrast to the leaves and fruit, and with a pocket or miner's glass, they can be seen quite plainly in all their ugliness, for they are perhaps the most repulsive looking of all our plant pests.

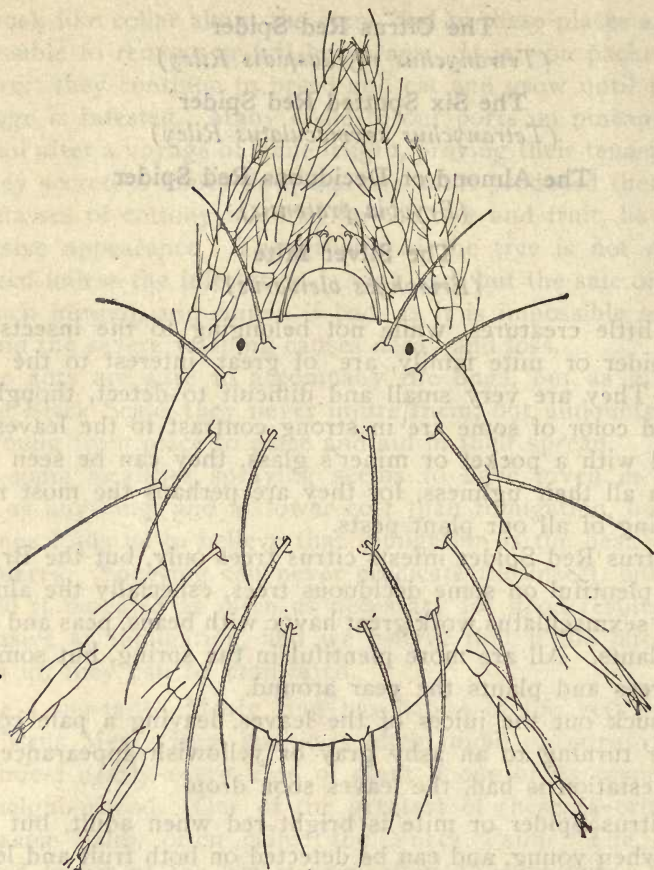
The Citrus Red Spider infests citrus trees only, but the *Bryobia* are very plentiful on some deciduous trees, especially the almond, while the *sexmaculatus* work great havoc with beans, peas and other similar plants. All are more plentiful in the spring, but some are on the trees and plants the year around.

They suck out the juices of the leaves, leaving a pale colored spot later turning to an ashy gray or yellowish appearance, and if the infestation is bad, the leaves soon drop.

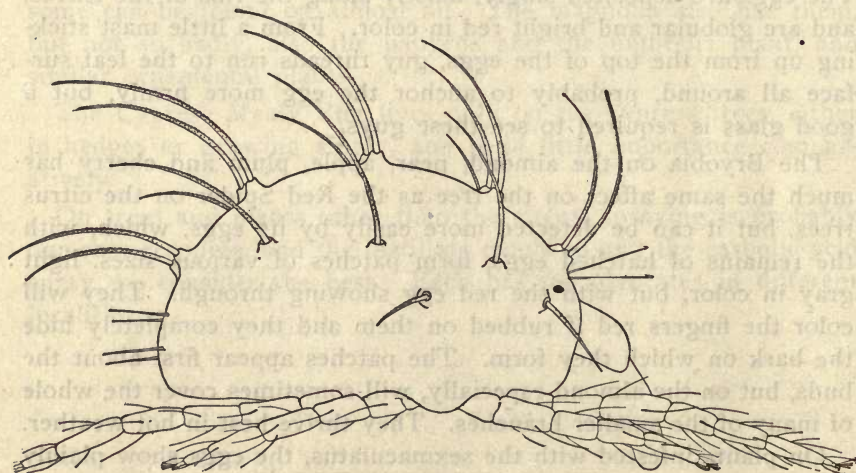
The Citrus Spider or mite is bright red when adult, but paler in color when young, and can be detected on both fruit and leaves. The eggs are deposited singly, mostly along the ribs of the leaves, and are globular and bright red in color. From a little mast sticking up from the top of the eggs, guy threads run to the leaf surface all around, probably to anchor the egg more firmly, but a good glass is required to see these guys.

The *Bryobia* on the almond, pear, apple, plum and cherry has much the same affect on the tree as the Red Spider on the citrus trees, but it can be detected more easily by its eggs, which, with the remains of hatched eggs, form patches of various sizes, light gray in color, but with the red egg showing through. They will color the fingers red if rubbed on them and they completely hide the bark on which they form. The patches appear first about the buds, but on the almond especially, will sometimes cover the whole of many of the smaller branches. They thrive best in hot weather.

On plants infested with the *sexmaculatus*, the eggs show plainly



Citrus Red Spider, Female.

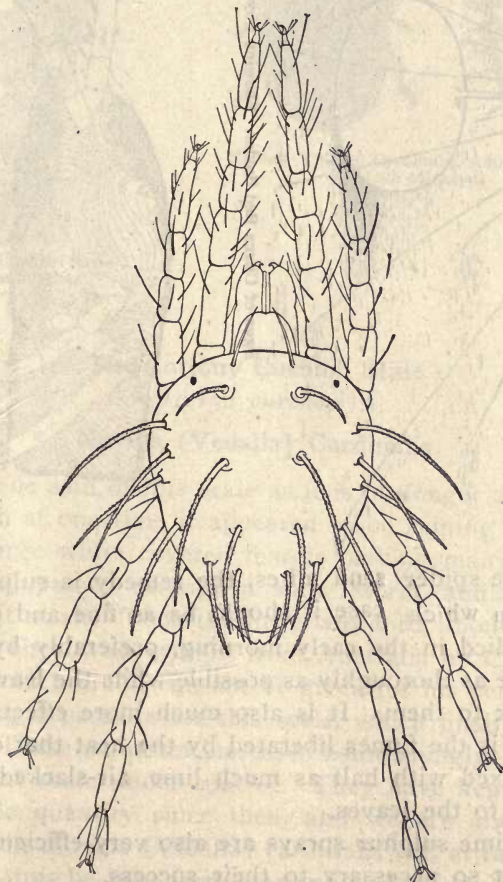


Citrus Red Spider, side view, Female.

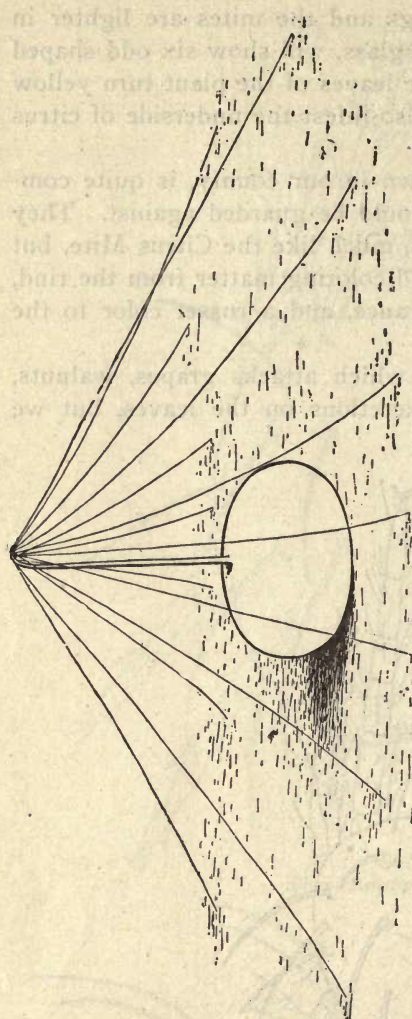
in small masses, but both the eggs and the mites are lighter in color, and the latter, under a good glass, will show six odd shaped spots on the back. They make the leaves of the plant turn yellow and fall, beans especially. They also infest the underside of citrus leaves.

The Silver Mite, while not known in our county, is quite common in a neighboring one, and should be guarded against. They work on citrus trees, on the leaves, much like the Citrus Mite, but on the fruit they extract the oil and coloring matter from the rind, giving the lemon a silvery appearance, and a russet color to the orange.

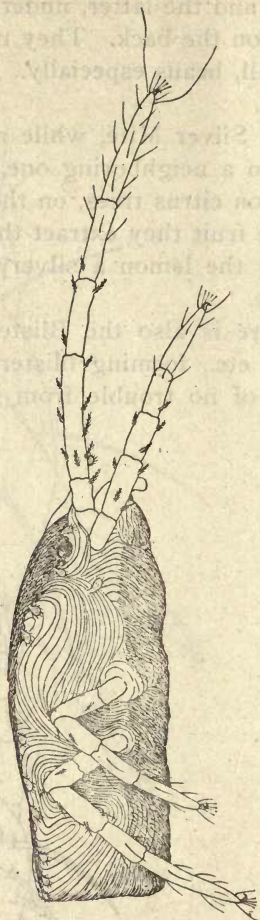
There is also the Blister Mite which attacks grapes, walnuts, pears, etc., forming blister like excretions on the leaves, but we know of no trouble from it here.



Citrus Red Spider (*Tetranychus mytelaspides*) Male.



Eggs of Citrus Red Spider. Showing gey threads, very much enlarged.



Almond or Deciduous Red Spider. (*Broobia pratensis*)

For all these spider sand mites, the remedy is sulphur. It can be used dry in which case it should be as fine and pure as possible, and applied in the early morning, preferably by blowing it into the foliage as thoroughly as possible while the leaves are damp so it will stick to them. It is also much more effective in warm weather, as it is the fumes liberated by the heat that do the work. It is often mixed with half as much lime, air-slacked, to make it adhere better to the leaves.

The liquid lime sulphur sprays are also very efficient, and warm weather is not so necessary to their success.



Cotton Cushion Scale
(*Icerya purchasi*)

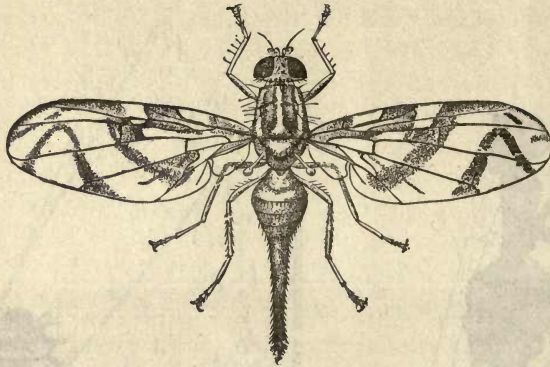


Novius (*Vedalia*) *Cardinalis*, Adult and Larva.
Much enlarged.

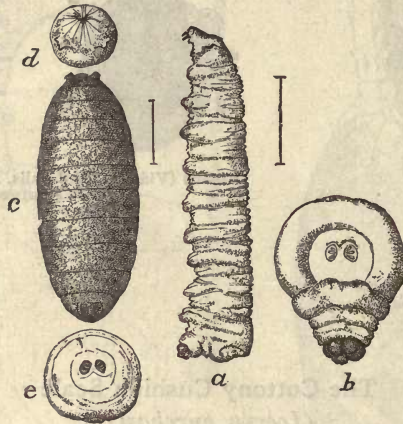
The Cottony Cushion Scale (*Icerya purchasi*)

Novius (*Vedalia*) *Cardinalis*

Little need be said of this scale as it is no longer a pest in California, though at one time it appeared to be ruining the citrus industry, the large white covered insects making many groves look as if they had passed through a snow storm, and no treatment would check it at all. Then the little lady-bird, about one-half the size of a bird shot, was brought from Australia by Chas. Koebele, to whom too much credit can not be given for his persistent advocacy of getting a parasite for this scale, which finally resulted so beneficially. These parasites increased astonishingly, and in a few months had the scale under control. They have kept them down to a negligible quantity since then, and we are always glad to see a few, as the *Novius (Vedalia) cardinalis* will always find them soon and will thus be kept from starving and dying out.



The adult female of the Mexican orange maggot (*Anastrepha ludens*)
(U. S. Dept. of Agrcl.)



Mexican Orange Maggot (*Anastrepha ludens*). A.-Larva, B.-Anal segment of same, C.-Pupa, D.-Head of same. A and E enlarged, B, D and C more enlarged.

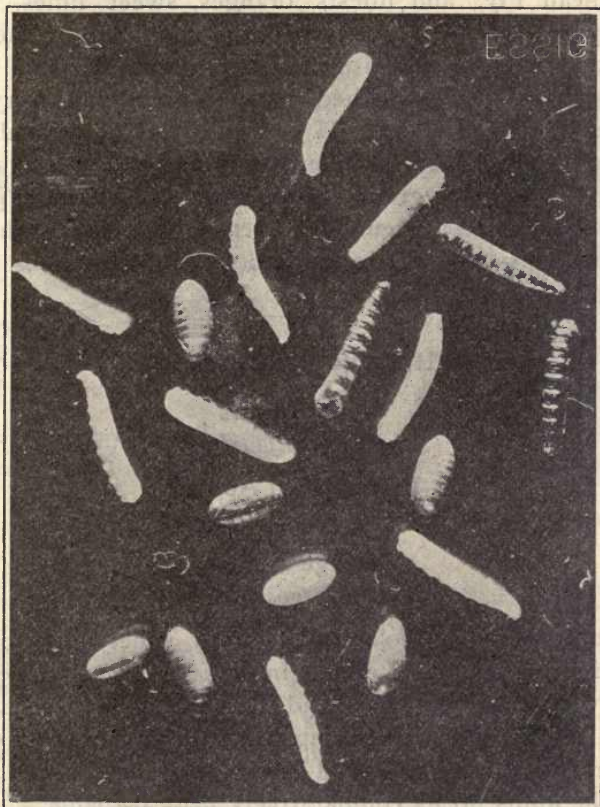
The Mexican Orange Maggot (*Anastrepha ludens*)

The Mediterranean Fruit Fly (*Ceratitis capitata*)

The Citrus White Fly (*Aleyrodes citri*)

These three fruit pests are the ones our state quarantine officers are watching more closely than any coming in on foreign fruits and trees. The first two have not yet, so far as we know, obtained a foothold in our State, and only one or two very small infestations are known of the white fly. These last are being fought persistently regardless of expense and effect on trees and plants,

and it is confidently expected that they will be exterminated in a short time. They are decreasing every year. The adult is a minute white fly, one-tenth of an inch long, looking as if it had been sprinkled with flour, and the immature form is a flat, greenish scale-like insect with habits much like the other scales, but nearly transparent and of waxy appearance. It is less than one-sixteenth of an inch long and lays very flat on the under side of the leaf.



Maggots and Puparia of the Mediterranean fruit fly
(*Ceratitidis capitata*).

It deposits the honey dew and the resulting black smut is very bad. In Florida it is their worst citrus pest, and must be driven out of California at any cost.

The Mediterranean Fruit Fly deposits its eggs in the fruit and they hatch out into an army of white maggots just about the time the fruit ripens. They soon work through the pulp and it rapidly

becomes decayed. The fruit drops to the ground and the worms, which will curl up and snap themselves an amazing distance, at once burrow into the ground where they pupate and soon emerge as a fly.

They affect almost all kinds of fruit and vegetables except pine-apples and bananas, which are the only fruit admitted from Hawaii on this account.

The Mexican Orange Maggot has almost the same habits as the Mediterranean Fly, and infests oranges, sweet limes, mangoes, achras sapotes, peaches, guavas and plums. All of these fruits from Mexico are excluded from California and Arizona.

These pests should be watched for very carefully in every orchard and wherever fruit is found. If you find fruit or vegetables filled with maggots, do not throw them away and thus give the worms a chance to go into the ground and mature and start the pest here. Wrap the fruit up to prevent their escape, and send to the nearest Horticultural Inspector for investigation. It is a serious matter.

APHIS OR PLANT LICE

Woolly Aphis

(*Schizoneura lanigera*)

Black Peach Aphis

(*Aphis persicae niger*)

Orange Aphis

(*Aphis gossipi*)

The aphis family is probably the most widely distributed and most prolific of any plant eating insects known, and were it not for many very active parasites, and the work of predaceous insects, we should find it difficult to bring to maturity any plant life.

However, the above mentioned friends work hard for us and most kinds of the aphis do us comparatively little damage.

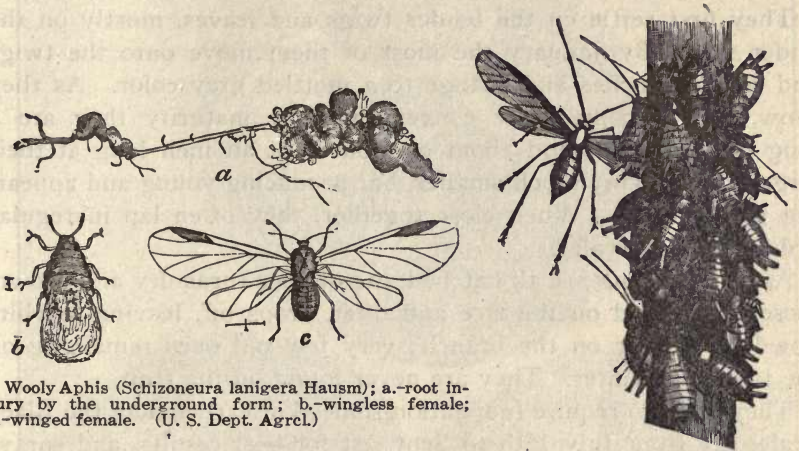
We have aphis known as the orange, the green rose, the brown or black, the melon, the black peach, the woolly aphis, and many more of less importance.

The Black Peach, the Melon and the Wolly Aphis are the ones most important for the fruit grower to control, as the care of orange trees for other pests almost always subdues the aphis on them. The Melon Aphis is now managed by placing colonies of the common spotted and red ladybirds in the melon patch. They

can be obtained from the State Insectary. Ashes or lime placed on the damp vines is recommended.

The Black Peach Aphis and the Wolly Aphis attack both the top and the roots, the Black Peach Aphis attacking peach and other stone fruit trees, and the Woolly Aphis attacking apple trees.

The Black Peach Aphis seems not to be seriously regarded in the East, but on sandy soils of this County, it has caused much alarm and some trees have been killed to stop it from spreading.



Woolly Aphis (*Schizoneura lanigera* Hausm); a.-root injury by the underground form; b.-wingless female; c.-winged female. (U. S. Dept. Agrcl.)

Black Peach Aphis (*Aphis persicae-niger*)

The only remedy here seems to be a solution of potassium cyanide placed in a trench around the roots of the tree, or carbon bisulphide put about one foot below the surface, close to the tap root, and either remedy is quite likely to kill the tree, though the cyanide is least severe. In each case the top should be sprayed well with krosene emulsion at the same time.

The Woolly Aphis is controlled by the application of wood ashes, tobacco stems, or kerosene emulsion about the roots near the tree, and the kerosene emulsion spray for the top. This treatment is recommended by many authorities for the Black Peach Aphis, but it is not efficient here for this species.

The swollen yellow bodies of the Orange and Rose Aphis, with a hole in the top of each, show the work of the parasitic fly which keeps them in control, and if any treatment is needed, tobacco solution will do the work.

The Longulus Scale

This is a new variety, the origin of which no one seems to know, and which infests only the citrus trees in a small territory in one section of the County. It is described as somewhat like to the Soft Brown Scale in some stages, and has been sometimes so classed.

It seems to rear but one brood per year which appear anywhere from May 1st to August 20th. The young are much like those of the Soft Brown Scale, but a little larger and more yellow at first, and after settling, become more flat, a greenish color, and more transparent than the Soft Brown Scale.

They first settle on the tender twigs and leaves, mostly on the under side. By January the most of them move onto the twigs and small branches and change to a mottled gray color. As they grow, they become more convex, until at maturity they are a long oval in shape and about one-fourth of an inch long at their largest, with many much smaller, but producing young and appearing to be adults. When close together, they often lap in regular order like fish scales.

After the young are all hatched, the mother turns dry and brown, loosens her hold on the tree and often drops off, leaving a white powdery residue on the branch; very few old ones remaining on the tree over winter. They are never found on the fruit.

They seem to require fumigation somewhat earlier than the Black Scale, say from July 15th to Sept. 1st for best results, and sprays have proved useless. There seems to be very little work of parasites on this scale.

Pear Thrips

(*Euthrips pyri*)

Citrus Thrips

(*Euthrips citri*)

Bean Thrips

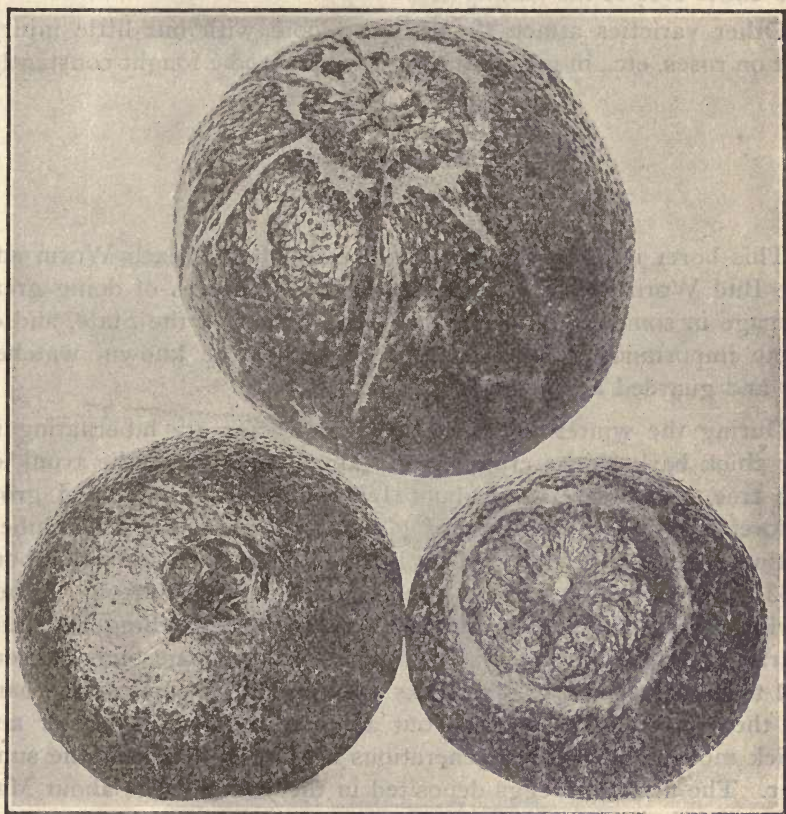
(*Euthrips fasciatus*)

The thrips are very small, active, hopping and flying insects, probably native to California. There are many kinds, of which we will speak of a few.

The Orange Thrip is dark yellow, with a life term of about 20 days, hence are constantly being born and dying. They attack the tender leaves and twigs of the orange early in the season, and later the fruit, and the fruit is scarred in a peculiar manner. A ring is formed around either or both ends and the lines radiate

from the rings, sometimes uniting them. Solid and irregular lines and patches are also made.

The insect is of little importance in this County, but in some other parts of the state is a very serious pest. The control measure recommended by the U. S. Government investigators is a spray made up of the following:



Work of Orange Thrip. Note peculiar arrangement of scars in circles and radiating lines.

2 $\frac{3}{4}$ gallons of lime-sulphur solution (33° Beaume).

2 gallons black leaf (2 $\frac{3}{4}$ % nicotine).

(or 14 fluid oz. black leaf 40).

200 gallons of water.

Thoroughly drench the tree with this spray, especially on the outside. Apply three times during the spring months to save the fruit and leaves, and once in the fall to save the fall growth.

The Pear Thrip in the region around San Francisco Bay attacks pears, plums, prunes, etc., but as the insect spends eleven months in the ground, thorough plowing and cultivation helps much in its control. It attacks the leaves and scars the young fruit. The above spray applied in March and again in April is recommended.

The Bean Thrip does much damage to beans and peas, attacking the under side of the leaves.

Other varieties attack the orange bloom with but little injury, but on roses, etc., in greenhouses, they have to be fought constantly.

Peach Twig Borer

(*Anarsia lineatella*)

This borer is also known as the Peach Moth, Peach Worm and the Bud Worm. It is a peculiar insect, the means of doing great damage in some of the deciduous fruit regions of the State, and of some importance in our County. It should be known, watched for and guarded against carefully.

During the winter the little larva or worms are hibernating in the thick bark at the crotches and about wounds in the trunk of the tree. They are only about 1-32 of an inch long, and grow before pupating to a length of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch. Their hibernating place can be detected by little chimneys of bark pulp about 1-32 of an inch high erected at the mouth of each burrow. When spring arrives they come out and bore into the swelling buds and starting twigs, killing them. New grafts and dormant buds are very apt to be attacked. In six weeks they pupate in curls of the bark on the trunk and soon come out a moth of steel gray color and quick movement. Three generations are hatched during the summer. The first from eggs deposited in the young twigs about May 10th. These bore into the pith of the twig and kill it, then later enter the fruit about the stem and after injuring it considerably, come out and pupate during June, July and August in the suture cleft of the fruit near the stem. In a week the second moth appears depositing eggs on the fruit near the stem dent. In a week these hatch out worms which eat into the fruit working there for a month, then coming out to pupate again, the third moth appearing in a week to deposit eggs in cracks of the bark from which hatch the worms which at once begin burrowing, in the crotches of the trees, the chambers with chimneys, in which to pass the winter.

Remedy: Lime-sulphur spray applied hot if possible, just before blooming time.



Peach Twig Borer (*Anarsia lineatella*). Little chimney at mouth of winter burrow at crotch of branch.



Young twig showing entrance hole of Peach Twig Borer.



Young twig showing work of Peach Twig Borer.

The Rose and Berry Scale (*Aulacaspis rosae*)

This scale is a very serious pest to the berry grower, and a great annoyance to the rose lover at times.

It appears a dead white, on the canes of the bushes near the ground, and looks much like splashes of whitewash thrown on them. The scale pulled off, reveals the tiny red insect beneath. They particularly like loganberries and often ruin the plants.

The best remedy is to cut out the old canes as soon as done bearing, and spray those remaining with kerosene emulsion, digging the soil away around the roots to allow the fluid to penetrate to them as the scale often infests the canes below the surface.



Twelve Spotted Leaf Beetle (*Diabrotica soror*)
Much enlarged.

Diabrotica Soror

This is the familiar green beetle with twelve black spots. It is found everywhere, on all sorts of plants, and on all of them it does more or less damage. The tender growth of the orange tree is often attacked, freshly budded and young trees being especially subject to them, but the lemon seems to be immune. The larva lives in the ground and gets its food there. There are two ways to control these beetles. One may jar or shake them off from young

trees in the early morning when sluggish, letting them drop in a tared or oiled surface, or they may be poisoned with a spray of arsenate of lead, 8 lbs. to 200 gals. of water, or 1½ lbs. of paris green to 200 gals. of water.

The beetles occasionally do serious damage to melon vines.



Work of *Diabrotica sorer* on orange leaves.

The Coddling Moth (*Carpocapsa pomonella*)

This the most troublesome pest of the apple, lives in the form of larva, or pupa, during the winter, in the ground or in any sheltered place available, and on the arrival of spring, assumes the form of the adult moth and begins laying eggs, mostly on the upper sides of the largest of the new leaves. The eggs are flat, transparent, and about the size of a pinhead.

The trees are now beginning to blossom and as the larva mostly enter the fruit through the blossom end, the poison spray is used, applied from above to fill the cup in the blossom end or calyx before it closes, as it will do when the fruit is well set. As the bloom is often not even, this spray may have to be repeated to poison all the cups, and even a third spraying may be necessary. As the eggs begin to hatch, spray again to kill all the worms possible, as some will enter the fruit at the side, not through the calyx, and this spray may be repeated in three weeks, and even a third time with profit. These sprayings should wet the whole tree thoroughly with a very fine spray, but be stopped long before dripping begins, as if too much is used the liquid runs together, is not so effective, and is more liable to burn the foliage. This early treatment is the important one as one worm destroyed now prevents the breeding of one or two hundred later. This should get about all the worms but if some escape and pupate later, forming moths to deposit eggs, spray again in midsummer when these eggs are hatching. The condition of moths, larva and eggs are best watched by placing cocoons in a screen covered box, as the eggs are hard to find on the leaves.

The best spray is the arsenate of lead, as it adheres to the leaves better and longer and is less liable to injure the foliage than paris green spray.

All sorts of rubbish in which the cocoons can winter should be religiously cleaned up, in and around the orchard, and places in which infested apples are stored should be made tight enough to prevent the worms escaping to breed again in the orchard. Windows even should be screened.

Peach Root-Borer (*Sanninoidea opalescens*)

This is a very injurious insect in the Santa Clara Valley, and of course liable to be brought here on nursery stock at any time. Stone fruit trees are its prey, and it can always be detected by the mass of gum exuding from the tree near the base where it is working. They, of course, injure the tree in proportion to their numbers, sometimes girdling and killing it. The usual method of treatment is to dig out the worms, probe all the burrows possible with a wire, and fill them with coal oil, then apply a thick whitewash made by slacking 16 lbs. of lime and pouring in 1 gallon of 16° Beaume crude oil while doing so.

If the worms are very numerous, the trees are likely to be much injured in getting them out. A blacksmith's hook-pointed hoof knife

is a good digging tool. A treatment recommended by our State experiment station is to dig away the soil about the roots of the tree down to the crown and fill up with loose soil, then pour on this loose earth, carbon bisulphide from a half ounce to two ounces, according to the size of the tree and number of worms, and at once throw up a mound of loose earth about the tree. Wet earth will retain the bisulphide gas too long, to the injury of the trees, therefore if rain comes within twenty-four hours, take away the mound of earth.

The Corn Worm (*Heliothus armiger*)

This very common pest comes from eggs deposited by the moth on the corn silk almost as soon as it appears, and the resulting larva crawls to the young ear and begins its work.

The remedies are to poison the moth with molasses mixed with arsenate of lead or paris green, in dishes fastened about the height of corn ears, or better yet, plant an early crop of corn which will get the worms before the main crop is ready, then before the larva leave the ears to pupate in the ground, cut this crop and destroy it, or feed it green, thus saving the later crop.



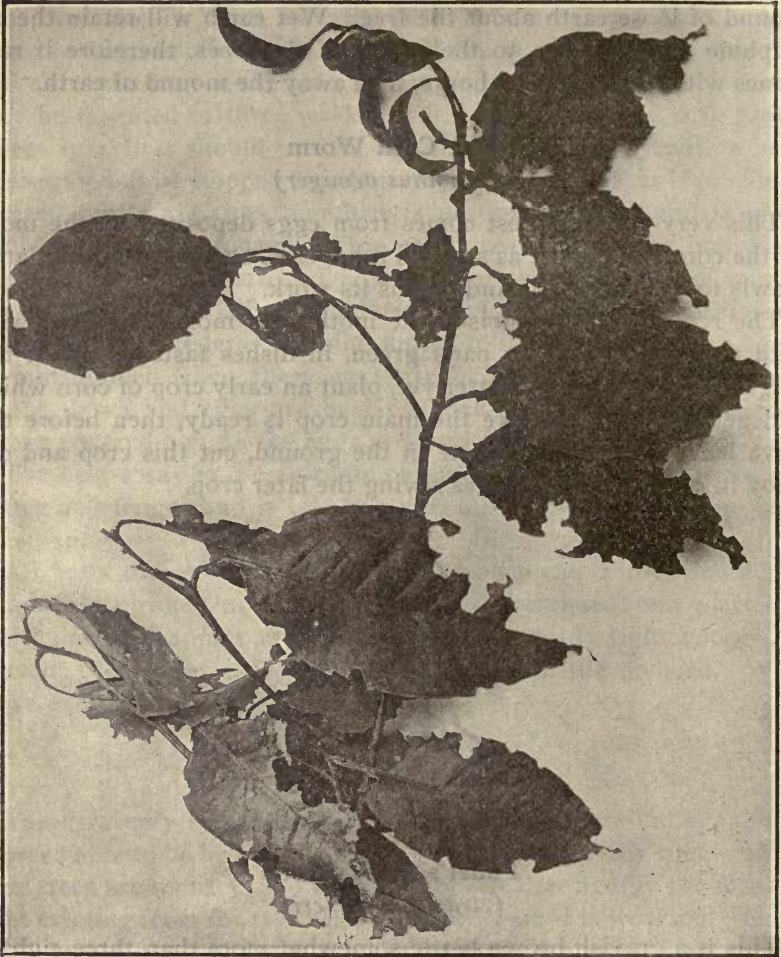
Fuller's Rose Beetle (*Aramigus fulleri*)

Fuller's Rose Beetle (*Aramigus fulleri*)

This is a grayish brown beetle somewhat more than three-eighths of an inch long. It tapers toward the head and has a short snout. They can be found on the under side of the leaves of trees or the forks of the branches, or clinging to a twig. They feed mostly at night, keeping quiet and much in the dark during the day. They are very injurious to strawberry plants, and new stock must be obtained frequently from uninfested districts to raise them profitably here. No plants for new beds should be taken from beds in

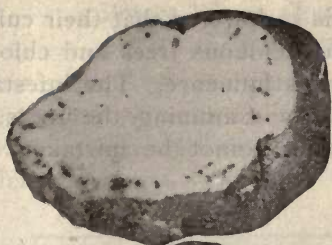
this county which have not been renewed within one year with plants from an immune district, some place where severe frosts keep out this pest. There is practically no remedy for infested plants.

The beetles work on young orange trees also, and especially on

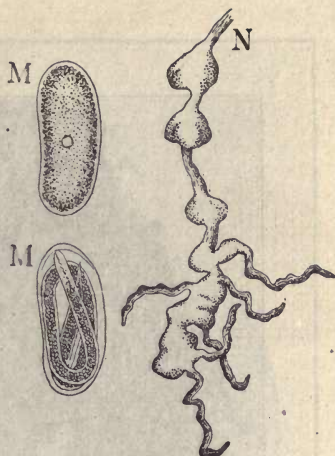


Young orange foliage, showing work of Fuller's Rose Beetle.

starting buds of nursery stock, where they will make tatters of the new leaves and destroy the tender growth. The larva feed on tree and plant roots in the ground, doing much damage. The beetles can be kept out of the trees by bands of tanglefoot or cotton batting placed around the trunks.



Potato Eel Worm (*Heterodera radiculicola*)

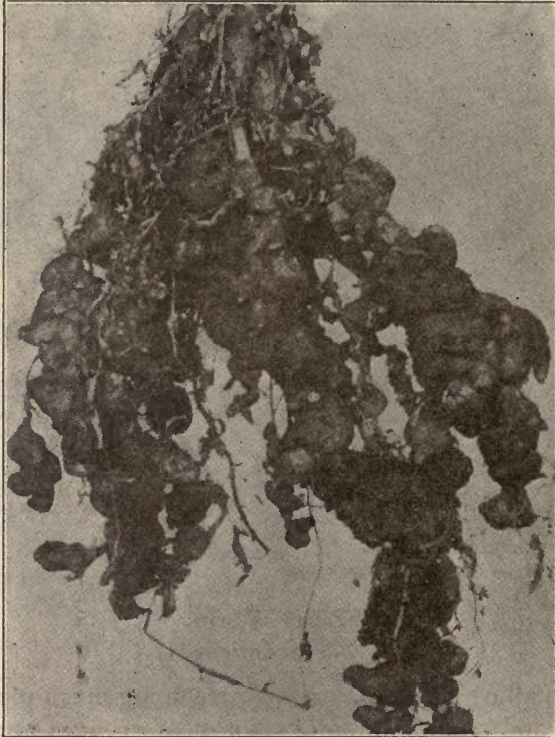


Eel Worm (Nematode)
Effect on root and much enlarged eggs
at different stages, found in roots.

The Eel Worm (*Heterodera radiculicola*)

These, and allied Nematode worms, are doing much more damage in the coast and mountain states than most growers are aware of. The fact that they seldom or never kill a tree or actually destroy a potato is probably largely responsible for this. The insect is a microscopic worm which lives about $\frac{1}{8}$ to $\frac{1}{4}$ of an inch beneath the surface in plant roots of all kinds. We find its work in the roots of all kinds of garden plants, citrus and deciduous trees, and especially potatoes. These last show it by warts appearing all over the tubers, the skin even on these warts, not being much roughened, and on cutting the potato, dark specks will show just under the skin. The infested tree and plant roots are much misshapen by warts or swollen to shapeless masses, according to how badly they

are infested. In plants the vitality is so lowered that their cultivation is profitless, and hairy root on deciduous trees and chlorosis of the citrus trees are attributed to its influence. The infestation can be located with certainty only by examining the roots, but when found to any serious extent it cannot be mistaken. No

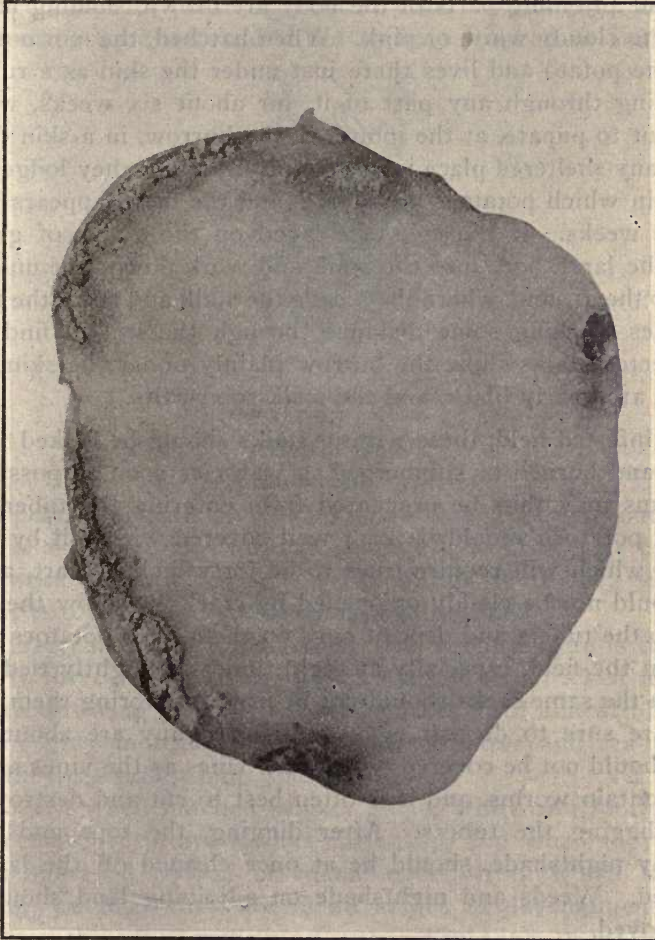


Nematode galls on cucumber root.

remedy is known for it, and we can only be careful not to plant infested potatoes or trees, or use infested land for trees or plants liable to it. Infested land can be used for grain, and if beets are planted in it and pulled and destroyed when half grown, before the mature worms escape into the soil, its condition is said to be much improved.

Potato Worm (Potato Moth, Tuber Moth)
(*Phthorimaea operculella*)

This is a serious pest, perhaps the most serious pest of the potato. It is reported all over California south of Sacramento, and though known in the middle west, does not seem to be prevalent in states bordering on ours.



Cross-section of potato showing tunnels just under the skin made by the Tuber moth (*Phthorimaea operculella*). This is but a mild infestation.

The worms infest not only potatoes, but other plants of that family, tobacco, "sodom apple," and nightshade.

The moth is grayish brown in color, about one-third of an inch

long, with well fringed wings. She deposits very small pearly white eggs, on the tubers when exposed, either before or after digging, or when stored in the bins or sacks, the larva entering about the eyes or in wounds. They also hatch and enter the growing stalks at the base of the leaves. The larva are about one-twenty-fifth of an inch long, white, transparent, with black heads, and they grow to the length of three-quarters of an inch, when their heads and adjoining parts of the body are brown, shading towards the rear to cloudy white or pink. When hatched, the worm at once enters the potato and lives there just under the skin as a rule, but also boring through any part of it, for about six weeks, when it comes out to pupate, at the mouth of the burrow, in a skin depression, or any sheltered place in the vicinity. Often they lodge in the sacking in which potatoes are stored, and the moth appears in two or three weeks. If the eggs are layed on the stalks of growing plants, the larva bore into the stalk and work down just under the skin into the ground, where they leave the stalk and enter the tubers, sometimes working some distance through the soil to find them. The affected stalks show the burrow plainly under the skin, as its contents are nearly black, and the stalk soon wilts.

In an infested field, these wilting stalks should be looked for and cut out and burned or submerged in water as soon as possible, as the worms may thus be prevented from entering the tubers. All growing potatoes should be kept well covered with soil by hilling up well, which will require rows to be forty inches apart, and the land should not be cloddy or opened by cracks to allow the moths to get to the tubers and deposit eggs on them. No potatoes should be left in the field, especially at night, unless in tightly tied sacks, and then the same sacks should not be used for storing them, as the moths are sure to deposit eggs on them if any are about. The tubers should not be covered with green vines as the vines are very apt to contain worms, and it is often best to cut and destroy vines before digging the tubers. After digging, the tops and weeds, especially nightshade, should be at once cleaned off the land and destroyed. Weeds and nightshade on adjoining land should also be destroyed.

When the potatoes are to be stored, if their infestation is suspected, soak them for 36 hours in as cold water as is obtainable. This thoroughly destroys the worms and will not injure the potatoes if the water is below 60°.

If the worm shows after the potatoes are stored, make the storage

room tight and place on the tubers a dish containing $1\frac{1}{2}$ to 2 lbs. of carbon bisulphide for each 1000 cubic feet of space enclosed, and repeat the dose as often as moths appear, usually four or five times will not be too much to exterminate them. The bisulphide gas will penetrate the sacks and save the crop if the bin is tight. The gas is explosive; keep fire away from it.

Infested potatoes should never be used for seed, nor infested land used again for potatoes the next year. Waste potatoes should be burned, not buried, and if fed to hogs, cooked or soaked well first.



Alfalfa Weevil (*Phytonomus posticus*) Adult.
Six times actual size.

Alfalfa Weevil (*Phytonomus posticus*)

This pest, which we have so far succeeded in keeping out of California, is a very serious menace to the alfalfa grower as evidenced by its work in Utah, Idaho and Wyoming, where they often ruin the first two crops and seriously injure the third.

The insect is one of the snout beetles, when mature is from one-eighth to three-sixteenths of an inch long, brown, flecked with gray or white; growing older, it becomes darker until almost black, still with the gray mottling. They are very active and ready to fly, which they can do for long distances.

The larva when hatched is very small, white and footless, later they become green, are always curled up, and when they pupate, form a spherical cocoon of coarse fibers, from which the adult emerges. In May they are in all stages of development on the plants, and the adults will live a year. The adult shows up on the first cutting of alfalfa in the spring and soon begins depositing eggs in the stems of the plant to the number of two or three hundred. The larva soon hatch out, very small at first, getting to work at once on the plants and leaves. As summer arrives, they hibernate under alfalfa, weeds, rubbish of all kinds, pupate in their cocoons,

and hatch in ten or twelve days. From about June they are all in the adult stage, very active at first, and easily carried by the wind, and after hibernating, by the transportation of hay, seed or almost anything in which they can hide.



Alfalfa Weevil (*Phytonomus posticus*)
Larvae and eggs on plant.
and larva enlarged

No means are known to check them when once established, and our only hope to escape them is to detect them at once when they arrive and kill them, infested plant and all, by the best means available. The State Horticultural Commissioner advocates piling straw on them and burning them. If you find anything suspicious, notify the State office at once, and if the area is small, apply the fire thoroughly.

Grape Phylloxera (*Phylloxera vastatrix*)

This is the grape pest feared above all others, not only in California, but everywhere that the vine is much cultivated. It is a plant louse, but it lives and works in several forms, sometimes on the vine above ground, but mostly on the root, and it requires two years to complete its life cycle. There is one form having wings to aid in spreading the infestation, which, however, is mostly done through shipping and planting infested nursery stock. Grape boxes may carry it at picking season, also anything coming in contact with the vine, soil, root or fruit. The injury done by this pest is mostly on the roots, which show small swellings, decay and death, and then of course the whole vine dies sooner or later, but there is much difference in the resistance of vines to the insect.

Some of our native vines are immune to the Phylloxera, and this is likely to save our grape industry, for if the improved varieties are grafted on to these immune roots, we need fear the pest but little, and eventually we hope that a strain of vines practically immune will be developed.

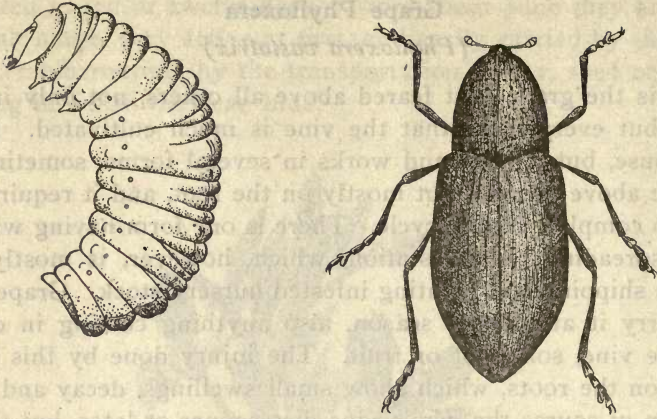
The indications of phylloxera are a decreased growth of the leaves, small bunches of grapes very lacking in sugar, yellow coloring and dropping of the leaves. The infested vines must be dug up, the land used for other crops for two or three years, and when replanted, resistant vines used.

A strict quarantine should be maintained against any infested district and all incoming nursery vines from anywhere should be carefully inspected to prevent new infestations of this pest.

The Cankerworm (*Alsophila pometaria*)

This pest, also known as the measuring worm, is the larva of a wingless moth which crawls up the tree in the fall and deposits about the twigs her masses of eggs which hatch in the spring and feed on the new leaves just putting out, sometimes defoliating the tree to its injury for more than a year.

Tree tanglefoot, the sticky coating of flypaper put about the trunk, will prevent the moths climbing the tree, if watched and kept fresh and sticky. It should be kept on from Nov. 1st to Jan. 15th.

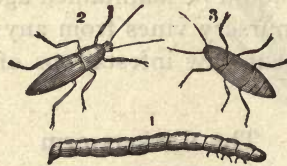


June Bug (*Lachnosterna* sp.)

June Bug
(*Lachnosterna* sp.)

The larva of this beetle are the white grubs so well known in our gardens. They live in the ground about two years, when after a season of pupation in the spring, they assume the adult form of medium sized brown beetles, and feed on the leaves of fruit trees and similar growth for a short time, during which they deposit their eggs in the soil and die. Their work on small trees is often quite injurious while they last.

Poisoning the foliage with arsenical sprays is the best means of combating them.



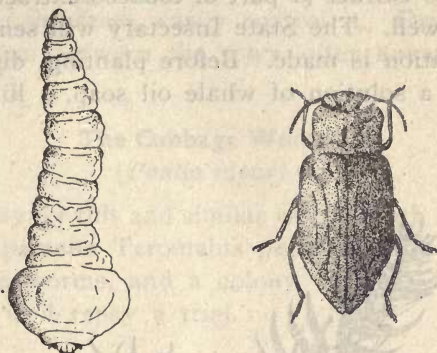
Wire-worms, larva and adult.

Wire Worms
(*Elateridae*)

These long, slim, brown, hard shelled worms, found a few inches below the surface in grass or grain land, are not usually very injurious, but when the land is used for trees or some new crop, and the old food plants are gone, they may do much harm. Young fruit trees, set in old grain fields, are sometimes attacked by them just below the surface and much injured, and even girdled and

killed. They also attack walnuts planted in nurseries, penetrating the shell and eating out the meat of the seed nut, also young beet plants and newly planted beans. The larva lives in the ground from one to three years before assuming the adult form, which is the click beetle, which throws itself sharply into the air when laid on its back.

In cases of injury to trees, the worms might be diverted from their work by growing grain or other favorite food between the rows to furnish them their usual form of food, and green alfalfa might be placed about the trees to temporarily divert them.



Flat Headed Borer (*Chrysobothris femorata*)

The Flat-headed Borer (*Chrysobothris femorata*)

These borers infest nearly all deciduous trees, and also berry canes, doing more or less damage. Protecting the parts attacked, the trunk or main stalk, from sunburn, is a preventive measure, as they always seek sunburned or injured spots. Shade young trees with two shakes stuck in the ground side by side, and whitewash older trees, putting some sulphur and soap in the whitewash. If already in the trees, dig out the dead bark and seal up with grafting wax. Cut all affected berry canes and cut and burn old ones as soon as done bearing. This will help also to check the white rose scale if you have any of it.

Bean and Pea Weevils (*Bruchus sp.*)

When the seed peas or beans have "bugs" in them, or the holes where bugs have been, place them before planting in a tight box (very tight) and set on top of the seed a shallow dish containing carbon bisulphide, 1 oz. to each 10 cubic feet of space in the box,

and leave it for six hours. This drug and its gas are explosive, so keep fire away. It will form gas which will kill the weevils, but the liquid should not touch the seed. If the land grew "buggy" peas last year raise a few very early peas first to be destroyed when nearly mature and the weevils get onto them.

Cabbage Aphis (*Aphis brassicae*)

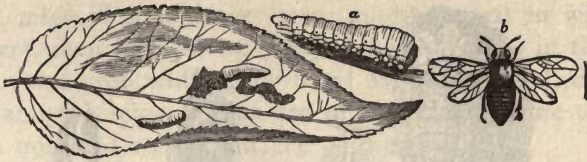
This aphid or plant louse is often very bad on cabbages, but a spray of tobacco extract (1 part of tobacco extract to 50 of water) will control it well. The State Insectary will send you a parasite for it if application is made. Before planting, dip all young cabbage plants in a solution of whale oil soap, 1 lb. to 5 gallons of water.



Norfolk Pine Scale (*Eriococcus araucariae*)

Norfolk Island Pine Scale (*Errococcus araucariae*)

This is a pure white oval scale, much rounded over the top and located at the base of and on the spines or leaves of the Norfolk island pine. On crushing, they yield a yellowish, red fluid, and seem to resist oil and caustic sprays; but good results are reported from the use of resin wash which seems to kill them.



Pear and Cherry-slug (*E. cerase*) a-larva, b-adult.

Pear and Cherry Slug

These insects do considerable damage to the foliage of pear and quince trees, eating out the leaf pulp and leaving only a skeleton of parts of the leaf attacked. Finely powdered lime or road dust, sifted on to the trees, easily control it. Dry soil shoveled over the trees from between the rows, often answers as well as anything.

The Cabbage Worm (*Pontia rapae*)

In gardens, spray for this and similar worms, with tobacco extract (1 to 50). The parasite *Teromalus puparium* is said to be very efficient for these worms, and a colony of them from the State Insectary would well repay a trial.

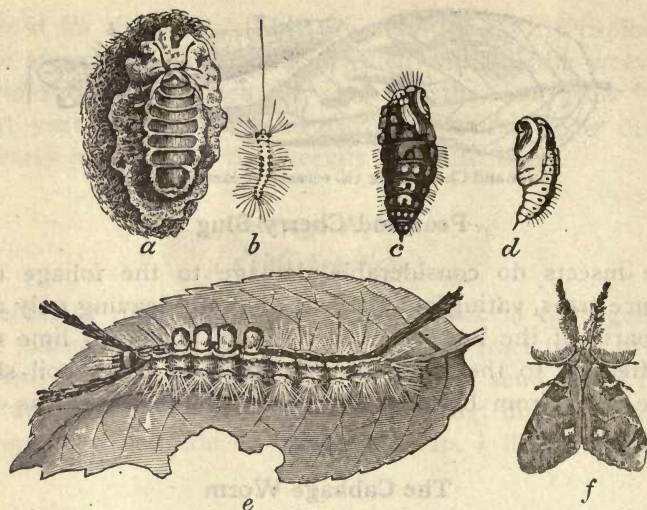
The Tent Caterpillar (*Malacosoma disstria*)

Wherever deciduous fruit trees grow these insects are found at times. They live in web nests, often very large and enclosing several branches, and eat the leaves on the part of the tree nearest them, often completely defoliating it.

The eggs are laid by a moth in summer, in clusters around the outer twigs of the tree, but do not hatch until the following spring, and when the trees are pruned in the winter they should be looked for, cut off, and all prunings burned. Any nests of the worms should also be cut out or burned on the tree with a torch.

The California Tussock Moth (*Hemerocampa vetusta*)

This pest, like the tent caterpillar, is hatched in the spring from an egg layed in the June before, and it attacks both leaves and fruit. The moth is practically wingless, and can be kept from climbing the trees by the tanglefoot bands. When beginning to feed, the worms can be jarred from the trees and prevented from



Tussock Moth (*H. vetusta*) a—female moth, b—young caterpillar, c—female pupa, d—male pupa, e—larva on leaf, f—male moth.

crawling up again by a steep mound of loose earth built around the foot of the tree. The tanglefoot will come in well here, too. These worms are intermittent in their infestations, indicating that some parasite cleans them up when it finds them.

False Chinch-bugs

(*Nysius angustatus*)

Squash-bugs

(*Anarsa tristis*)

Harlequin Cabbage-bugs

(*Murgantia histrionica*)

These are three insects which work in a very similar manner and all have the peculiarity, unlike others of their class, of emitting a disagreeable odor when crushed. They all have a sharp proboscis by which they suck the juices from the plants. This beak can be seen on turning the bug onto its back. They do not have a larval or grub form, the young being of similar form to the adult, but without wings, and of course, smaller. They attack all varieties of fruits and vegetables.

The False Chinch-bugs often seriously injure young orange trees, and the others are a bad strawberry pest. The young can be killed with kerosene emulsion. Keep all weeds and rubbish cleaned up on your land as the adults sleep in this material over winter.

Some such piles of rubbish or straw might be left in which they would collect, then burn them. When they show up in the spring, start some extra crop which they like. When they collect on that, destroy it and the bugs. They are practically immune to poisons as they do not feed on the surface of the plant.



Cut-worm Moth (Noctuidae sp.)

Cut Worms (Noctuidae sp.)

These troublesome insects are of various species, but all have similar habits, which are pretty well known everywhere.

They remain in the ground just beneath the surface during the day, coming out at night to cut our growing plants near the ground, to crawl up the trees and feed on the leaves, and the allied species, known as the Army Worm, goes in droves across the country, devouring everything in its path.

The adult forms of all these worms are night flying moths, and these may be caught to some extent, with lantern traps; a dish on top of a stake having coal oil or some sticky fluid in the bottom and a light just above it in the center, but the main dependence must be placed in poisons for the worms themselves.

For garden plants, like tomatoes, cabbages, potatoes, etc., put at the base of each plant a tablespoonful of brain into which paris-green has been thoroughly mixed in the proportion of 1 to 50, and then wet until it will stick together, with slightly sweetened water. The worms like this better than the plant. Lay a board 12 inches wide on the ground in the garden and leave it over night. In the morning you will find many worms under it which can easily be killed. This is an excellent trap for them.

A band of tree tanglefoot or cotton batting about the tree trunks will keep down those which climb trees.

The Army Worm is a different matter. On first discovering them, pile inflammable material on them and burn it; if the army is not too large. If they have begun to move, a furrow plowed across their course and kept constantly wet with kerosene has

been used with some success if persisted in. But they generally march with little check until they are ready to pupate. However, parasites and disease find them, and their numbers are decreased so that the second year seldom produces them in alarming numbers.

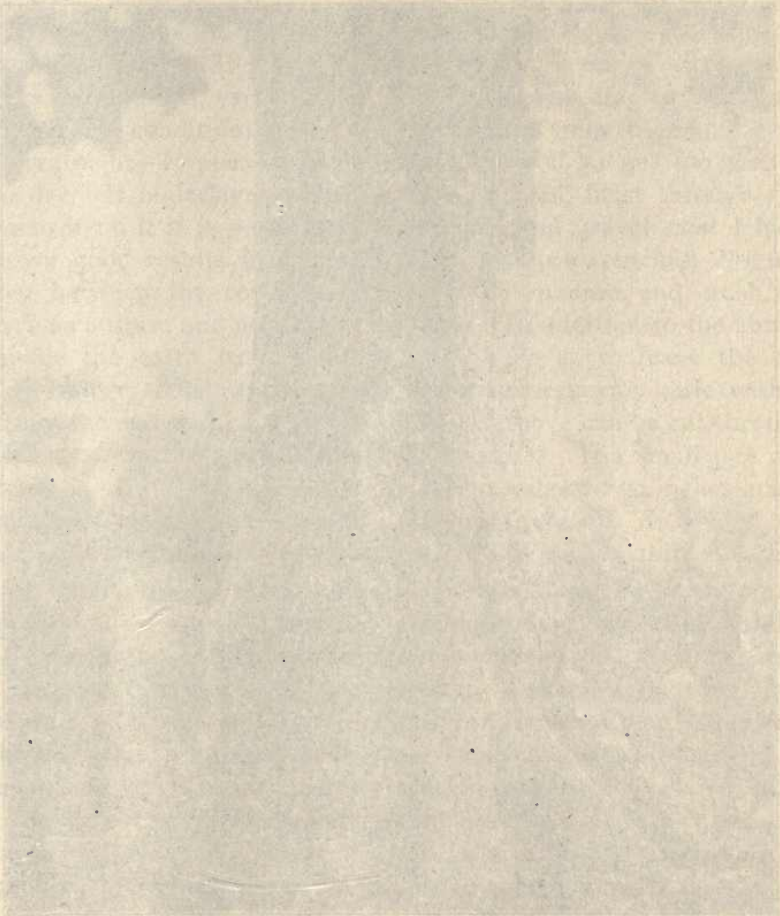


The native California Lady-bird (*Hippodamia convergens*)
Larvae and bursting pupa.

Native California Lady-birds

These native Lady-birds are of the utmost importance to the fruit and plant grower as they are constantly preying on the various young scales, mealy bug, and especially the aphis. Every one should learn to recognize the larva and pupa, as well as the adult beetles and protect and preserve them all as much as possible. The larva are so peculiar in appearance that once known they will never be mistaken for anything else. They are as repulsive and ferocious looking as the adult is the opposite. They reach a length of $\frac{3}{8}$ of an inch and vary from brown to black in color, some having bright red and yellow markings. They are nearly an eighth of an inch wide in the middle and taper nearly to a point at each end. They bristle all over, especially about the head, with short, black, coarse hairs. Some other Lady-birds, equally beneficial but not so numerous, have larva covered with tangled threads of pure white. Many of the native species are collected in the mountains, where they go to hibernate in the winter time; and are preserved in cold storage at the State Insectary to be distributed at the proper season to melon growers and others who request them for the control of aphis, and while no other species

have accomplished the spectacular performance of the Australian variety (*Novius cardinalis*), which saved the citrus industry of California some years ago from the White Scale, yet in their quiet way perhaps they are benefitting the growers of the State just as much and we must protect them in every possible way.



FUNGUS DISEASES

Gum Disease of Citrus Trees and Treatment

First we find there are two distinct forms of this disease. The first and most prevalent is that in which the gum oozes from under



Citrus Gum Disease; showing appearance of trunk affected.

the bark at, or just above, the ground. It first appears like a thick, syrupy matter, crystallizing after being exposed to the air. The first symptoms are a slight swelling of the outer bark, caused by the congestion of the sap, which must either break out or be forced

between the outer bark and cambium layer or inner bark. When this occurs, the cambium is destroyed as far as the congested sap extends, but fortunately the bark bursts under the pressure before the poisonous syrupy matter extends very far about the body of the tree. This reduces the pressure until the affected parts dry up, then if the cause is not removed, the same trouble will occur to the heretofore unaffected parts, and eventually girdle and destroy the tree.

Causes of this form of Gum Disease: Extreme moisture or drouth, clay or hard pan which hold up an excess of water, sand or gravel sub-soil, especially if underlayed with clay or hard pan. All of these conditions will cause this form of gum disease.

Treatment—If possible never allow the soil to get too wet or too dry. If underlayed with clay or hard pan, blast through and loosen it up if it is possible. Where sand and gravel exist I have known good results from digging one or more trenches, $2\frac{1}{2}$ feet deep between the rows, and filling with manure and trash, to serve as a drain and nourish small roots. In addition to the above, remove the earth from about the trunk so as to leave the top of the large roots exposed, then use a horseshoer's knife with a turn at the end of the blade. With this a groove can be cut through the bark from the roots to the large branches. If a small tree one groove is plenty, if a large tree cut grooves about two inches apart, then paint all of the body with pure neats foot oil. If a very bad case I would recommend cutting back the branches quite severely.

Trees budded on the seed stalk not less than six inches above the ground are usually less liable to this disease than those budded lower, and the higher the bud the better, as the seedling wood is much less liable to gum disease than the bud, as a rule. Care should be taken, in any case, not to plant the tree too deep. Some advocate planting so shallow that the crown roots are right at the surface.

Scaly Bark of Citrus Trees

This disease generally appears first on the large branches near the body of the tree, but in severe cases the whole body is affected. It first appears like small warty eruptions. Small quantities of gum ooze from the warts. This dries up and the eruptions apparently heal, but are immediately followed by others which spread quite rapidly, causing the outer bark to crack and scale up, hence the name "Scaly Bark." This disease is considered by many to be contagious.

Treatment—If a very bad case, I would advise the removal of the limb or branch, but ordinarily this disease can be cured by scraping off all of the rough, scabby bark, then treating with a strong solution of caustic potash, one pound dissolved in six gallons of water. Spray or brush the affected parts thoroughly with this solution three or four times during the year. I have also seen good results from the use of coal tar and carbolic solutions used in place of the caustic potash.

Chlorosis

(Lack of Nutrition)

In this trouble the leaves become yellow and pale, and the mottled appearance of the leaves often goes with it, though the latter trouble alone seems more easily remedied than the first, and when affecting young leaves and grafts will usually disappear in a short time if proper care is given the tree.

The sub-soil when very light or covered by a hard pan seems often to cause Chlorosis, and sometimes the Nematode Worm (similar to the potato eel worm) is blamed as the cause. Each case should be carefully investigated, the cause found and corrected. It is simply lack of proper nourishment in the tree.

Damping Off of Citrus Seedlings

(Rhizoctonia fusarium)

This is the shrinkage and decay of the stalk of citrus seed-bed stock and causes much loss every year. It is caused by an over wet soil. Seed beds should have one inch of clean sand on top with heavier soil beneath, and then only sufficient water used to give the plants good growth. Beginners should dig into the soil frequently to ascertain its moisture, and not water whenever the top sand gets dry.

If the "damping off" begins, stop watering at once and allow the bed to get as dry as the plants will stand. Then with a long toothed rake loosen the surface thoroughly, raking and cross-raking, even if some plants are disturbed and killed. This breaks up and destroys the fungus growths in the soil and will save many of the plants not yet attacked.

Frost Protection

With the citrus grower this is a very live and important subject, as very few places in Southern California escape an occasional

frost. The best appliances for this work are the sheet iron fire pots for burning petroleum, of which there are several kinds, each having its advocates and admirers.

The pots should be filled "as directed," and placed in the grove when cold spells are to be expected, usually one to a tree, set, however, in the open space between the trees, and an extra row along the east and north sides of the grove, and as a general rule, when the temperature at 2:00 a. m. drops to 26°, go through and light them as quickly as possible. This method has saved hundreds of thousands of dollars to the orange growers in California.

Wither Tip

(*Colletotrichum gloeosporioides*)

The effects of this disease, in a general way, consists in a spotting of the fruit and leaves and killing back of the twigs, and an attack upon the young newly formed fruit causing it to drop. It has increased considerably in the last 4 or 5 years, and is, no doubt, to some extent blamed for dying tops due to some other trouble. The distinguishing mark of the true wither tip is the appearance of minute black spots on twigs and dead portions of leaves, and a distinct yellow line on these leaves dividing this dead brown leaf surface from that which looks green and healthy. Under a good pocket glass these leaf spots show as small upright fungus growths all over the surface. The disease with this appearance is very common, showing more or less on most dead citrus twigs, and the minute spotting of lemons is often "laid to its charge."

Many expert pathologists believe that the disease is never serious unless the trees have been weakened by some other cause, and the work of Nematode Worms is mentioned as one of the causes. However, others think it more serious, but spraying with Bordeaux Mixture, or some form of blue vitriol solution is about the only remedy suggested and of course any treatment tending to promote vigorous vitality in the tree would be proper.

Florida Die Back

This disease begins to show itself in little blisters or swellings on the tender twigs, just a little puff on the twig $\frac{1}{4}$ to $\frac{3}{8}$ of an inch long and not at all discolored. On cutting open, these blisters will show a pocket of gum, and the twig soon begins to wilt and the leaves drop off. Also often some very large dark green leaves

will start in the middle of the tree, giving it a very thrifty look. A brown, corky growth soon comes on the affected twigs, looking like a fungus growth and covering a large part of the surface. After the leaves have fallen, a large number of extra buds start on the branch still living, and a multitude of twigs start from them forming brushy tufts through the tree. The fruit is small and pale in color, and has an insipid sweetness, with no acid qualities. The rind shows dark brown spots from which radiate cracks and splits in the fruit, and these splits often run in every direction. The disease seems to be the result of uneven growth; too much manure (nitrogenous or organic) applied after the vitality of the trees has been much reduced or when growing in a light soil, or the tree has suffered for water in a porous soil which dries out quickly, the irrigations being too far apart, and this porous soil may lie beneath a dark heavy surface soil.

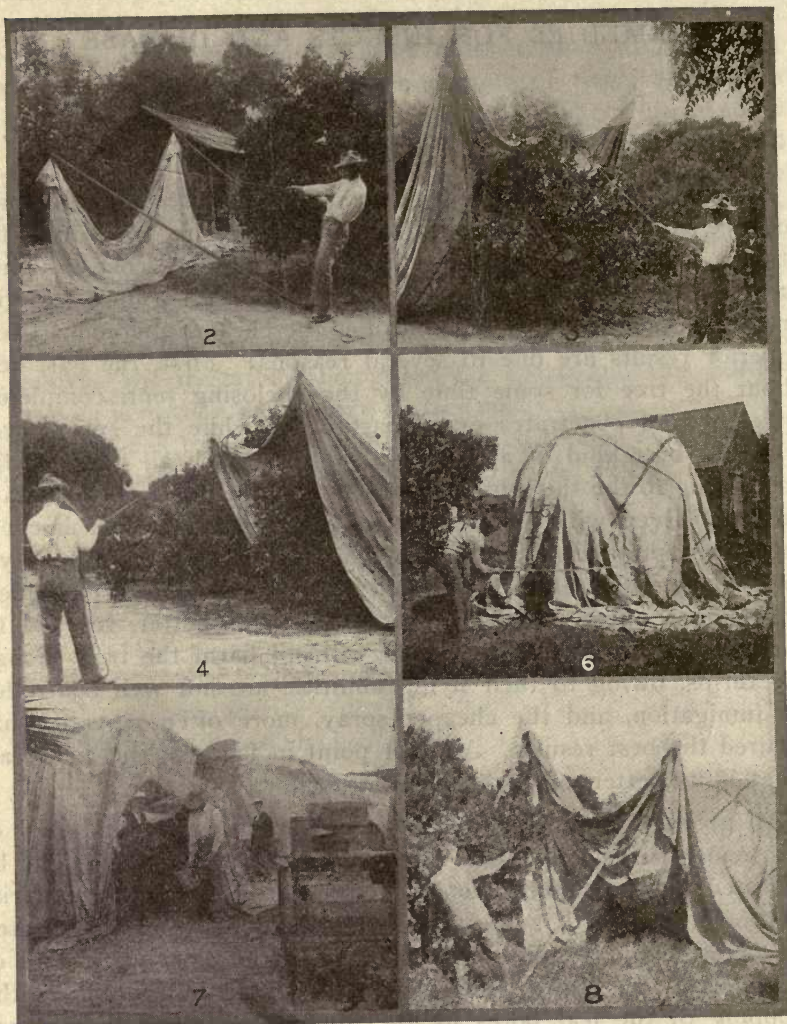
The remedy is to keep the condition of the tree as even as possible by fertilizing and irrigating frequently and lightly.

REMEDIES FOR INSECTS AND DISEASE

Fumigation

Fumigation with hydrocyanic acid gas has become the main reliance of the citrus fruit grower to preserve his trees from the attacks of the various scale pests, and although the cost is higher, probably twice that of spraying, the results are so much superior and more lasting that in the end it is the cheaper method. These superior results are due to several reasons: First, the gas, kept about the tree for some time by the enclosing tent, completely envelops and penetrates every part of it, while the spray, even with the best kind of application, fails to touch all parts of the tree owing to the thick foliage, which on the citrus trees is always present. Even with defoliated trees it is difficult to reach every part with spray, and it is seldom done in practice. We have yet to find any insect attacking the citrus tree, except the red spiders and similar mites, which are not as well, or better, reached by the gas than by any spray which will not harm the tree, though the thrips, owing to their flying abilities, are not well controlled by fumigation, and the cheaper spray, more often repeated, has secured the best results. Another point in favor of the gas treatment is its better effect on the tree itself.

All growers know that too frequent spraying will kill many of the tender twigs and lower the vitality of the tree, as might be expected to result from keeping a film of oily or soapy material on the young growth, and especially on the leaves where are located the breathing parts of the plant. One of the principal causes of injury from the Black Scale, Mealy Bug, and White Fly is the stopping of the leaf pores by the honey dew secreted by these insects and the accompanying smut growth, and this condition is not materially improved if, to destroy the scale, we apply another, perhaps equally harmful coating, to the foliage. In comparison with this checking of tree growth by the sprays, we have only to note the considerable stimulation of growth usually shown by the trees immediately after fumigation, to decide which benefits the tree most, aside from the help derived from the more complete destruction of the scale.



FIG'S 2-3-4—Successive stages in placing a tent over a tree with poles.

FIG. 6—A tented tree, showing method of securing the Distance around the bottom of the tent by means of a tape attached to an iron rod.

FIG. 7—Dosing a tree. FIG. 8—Removing a tent from one tree to another by means of poles.

(Bureau of Entomology, U. S. Dept. of Agriculture.)

Of course, too strong a dosage of gas will produce injury as well as too severe spraying, and judgment is required, not only to get a dose rightly proportioned to the size of the tree, but to properly adjust it to conditions of the atmosphere and temperature.

A damp atmosphere makes the tree more susceptible to burning by the gas, and of course if fog or rain makes the tree really wet, the fumigation must stop. A high temperature has a similar effect, and a combination of a hot night and a damp atmosphere is very dangerous. The same is true of a temperature below 32°. Fumigation can be done safely only in a dim light, and the night's work should never begin in bright weather sooner than sunset. Very bad burning of trees has often resulted from starting work too early in the evening or continuing too late in the morning.

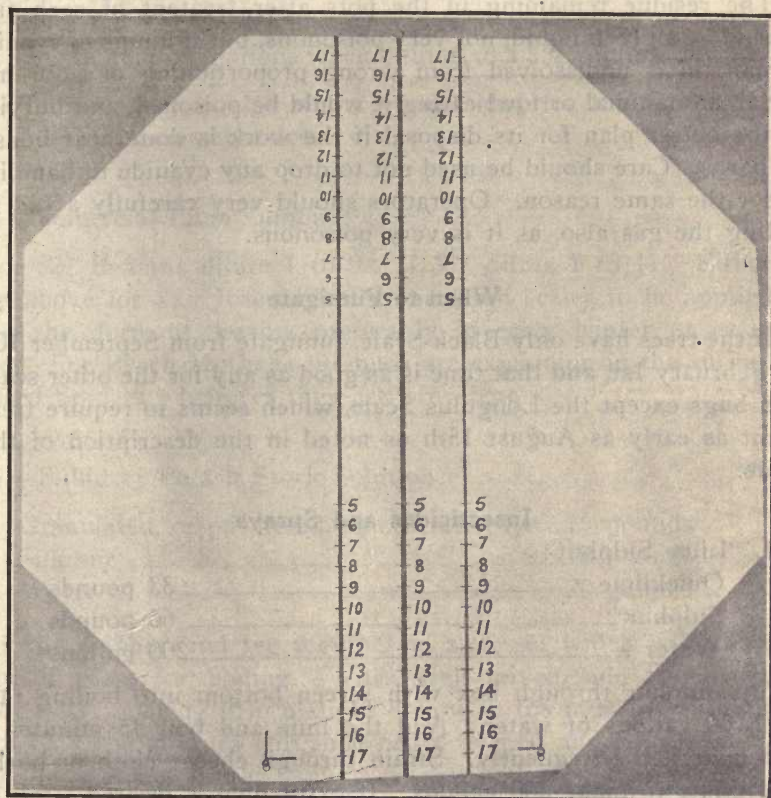
We can not account, at least not fully, for some other unexpected results in fumigation work, and we are obliged to confess that we do not fully understand this chemical process and its adaptation to our needs yet. However, we know enough about it to make decidedly the best killing of scale by its means, and with the least harmful results to the trees of any process we have.

How to Fumigate—First, tents must be provided large enough to cover the largest of the trees to be treated. Where there are several sizes, if some of the tents are large enough for the biggest trees, smaller ones can be used for the balance, or if only a few trees are too large for the tents at hand, these may be covered by using two or more tents, lapping the edges and closing the joints as well as possible. Sometimes three or four tents are applied around a very large tree, and one as a cap over the top. The joints of the tents in such cases, will of course, leak gas some, but surprisingly good results are obtained with careful work.

The tents now universally used in this County are simply an eight square sheet of sufficient size, made of various kinds of cloth, but mostly canvas, from 8 oz. to 10 oz., or drill of about 6 oz. in weight, double sewed, and with two rings attached by pieces of rope, firmly sewed on at two adjacent corners, by which the tent is drawn over the trees.

One or more marks are painted directly across the canvas on which each foot in length is shown by a short cross mark, each of which is numbered like a tape line, so that when the tent is on the tree this mark acts as a measure, showing the distance over the tree. These marks are made with very heavy lines and large figures so as to be easily read at night.

ing it in diluted surfuric acid. Potassium Cyanide requires for each ounce, one fluid ounce of acid diluted with three fluid ounces of water. Sodium Cyanide for each ounce requires $1\frac{1}{2}$ fluid ounces of acid diluted with 2 fluid ounces of water, but as $\frac{3}{4}$ of an ounce of the sodium is as strong as an ounce of the potassium, and it is a little cheaper per ounce, a saving is made in using it. This refers to the best grade of each chemical and it is important to



Method of Marking Tent.

use the best. With cyanide of potassium the best is known as 99% ; with cyanide of sodium it is called 129%, and the sulphuric acid is known as 93%.

These chemicals obtained from the general drug trade are not always sufficiently pure, and the Horticultural Commissioner's office will always be able to inform anyone how to get pure chemicals. We can also furnish the tables or schedules of dosage which will be correct.

One hundred cubic feet of tented space requires 1 oz. of potassium cyanide or $\frac{3}{4}$ oz. of sodium cyanide for a basis dose, which is used for most fumigation work, and is known as Schedule No. 1 for potassium cyanide and Schedule A for sodium cyanide, and they can be varied for any special infestation or condition of tree or atmosphere. For instance, a bad infestation of Mealy Bug would require $1\frac{1}{2}$ this schedule dose.

The residue remaining in the pots after treatment of each tree should be a green liquid, not very poisonous, but if lumps of cyanide remain in it undissolved from wrong proportioning or poor material, any animal or fowl eating it would be poisoned, and burying is the better plan for its disposal if the work is done near houses or barns. Care should be used not to drop any cyanide in handling it for the same reason. Operators should very carefully avoid inhaling the gas also, as it is very poisonous.

When to Fumigate

If the trees have only Black Scale, fumigate from September 10th to February 1st, and that time is as good as any for the other scales and bugs except the Longulus Scale, which seems to require treatment as early as August 15th as noted in the description of that scale.

Insecticides and Sprays

1. Lime Sulphur:

Quicklime	33 pounds
Sulphur	66 pounds
Water	200 gallons

Sift sulphur through box with screen bottom into boiling tank with 50 gallons of water. Add the lime and boil 45 minutes to one hour. Stir frequently. Strain through cheese cloth or burlap and dilute to make 200 gallons. If extra lime is desired strain in milk of lime when spray is ready for use.

$1\frac{1}{2}$. Self-boiled Lime Sulphur:

Fresh stone lime (not air slacked).....	32 pounds
Flowers of sulphur.....	32 pounds
Water to make.....	200 gallons

Place the lime in a barrel and pour on enough water to cover it. As soon as it begin to slack, sift in the sulphur so that all lumps will be broken up fine. Stir constantly, and add water slowly to make a thick paste, then, as soon as the slacking is com-

pleted dilute to a thin paste, then to a liquid thin enough to strain, then add the balance of the water and use.

The heat of the slacking lime will boil the mixture for several minutes and hot water is better for thinning the paste so as to prolong the period of heat, which is necessary to dissolve the sulphur.

Rex lime sulphur spray sold ready prepared has produced excellent results for Red Spider on citrus trees. It costs about eighty cents per one hundred gallons when diluted to a 3% solution for use.

The Ortho spray is also well recommended for the same purpose and costs somewhat less.

2. Commercial Lime Sulphur:

If of 32° Beaume dilute 1 to 9. If 36° dilute 1 to 11. Either of the above for San Jose and other armored scales to be applied during the dormant season, preferably in early winter or early spring. For Peach Moth, as the buds are expanding in the spring. For Red Spiders whenever they are prevalent.

2½. Sulfid of Potash Stock Solution:

Granulated, or powdered concentrated lye.....	15 pounds
Sulphur	18 pounds
Water to make.....	20 gallons

Stir the sulphur and lye together in a vessel which will allow plenty of room for boiling. When well mixed, add about one pint of water, placing it in a slight hollow in the mixture, and stir in slowly. The mixture will soon begin to melt and boil, forming a red fluid; stir until the boiling ceases, and then add water to make 20 gallons. This stock solution will keep for awhile, or indefinitely when protected from the air.

Preparation of the Spray Mixture with Sulfid of Potash—Place 10 to 15 pounds of sublimed sulphur, or 14 to 20 pounds of ground sulphur in the spray tank with 4 gallons of flour paste and 1 to 2 gallons of the sulfid of potash stock solution; add water to make 100 gallons. For summer or spring spraying after the danger of rains is over, the minimum amount of sulphur is sufficient. Used for Red Spider.

3. Distillate 28° to 30° Baume:

Distillate	10 to 20 gallons
Water	200 gallons

For use only with power sprayer with good agitator, which is necessary to make a mechanical mixture of the oil and water. For the Brown Apricot, Black and other unarmored Scales, and for Woolly Aphis, to be applied during the dormant season, preferably in early winter.

4. Distillate Emulsion: Stock emulsion—

Hot water	12 gallons
Fish oil soap (see No. 12) or whale-oil soap.....	30 gallons lbs.
Distillate 30° to 40°.....	20 gallons

Add soap to hot water in spray tank with agitator going. After soap is dissolved add oil slowly, keeping mixture agitated. Pump out through nozzle at 175 pounds pressure into storage tank.

For use take—

Stock emulsion	11 gallons
Blackleaf 40	1 pint
Water	200 gallons

Place oil emulsion in spray tank, start agitator and add the water. When diluted add the Blackleaf. For Thrips, Black Peach Aphis and other plant lice.

5. Kerosene Emulsion:

Dissolve $\frac{1}{2}$ lb. soap in 1 gallon hot water; add 1 gallon of kerosene.

Mix thoroughly with spray pump by turning nozzle back into mixture. For plant lice and other sucking insects during growing season, dilute with 15 to 25 gallons of water. For scale insects, Woolly Aphis and other sucking insects during dormant season, dilute with 5 to 10 gallons water. For use on small scale with sprayer.

6. Kerosene Emulsion. Kitchen formula:

Dissolve 1 inch cube soap in 1 pint hot water; add 1 pint kerosene. Churn with egg beater.

For growing plants, dilute to 2 or 3 gallons water. For dormant plants, 1 gallon.

7. Miscible Oils:

Commercial preparations of oil so treated as to mix directly with water. Follow directions on container. Uses same as 3, 4, 5, 8, 9 and 12.

8. Straight Kerosene or Water White Oil:

Water white oil (42° Baume) or kerosene..... 20 gallons

Water200 gallons

In use for scale insects on citrus trees. Application by power outfit.

9. Soap Solution:

Soap 1 pound

Water5 to 15 pounds

Whale-oil or fish-oil soap preferable, but for small amounts any yellow laundry soap will answer. For plant lice and other sucking insects during summer.

10. Carbolic Acid Emulsion:

Whale-oil soap40 pounds

Crude carbolic acid..... 5 gallons

Water to make.....40 gallons

Dissolve soap well in hot water, add carbolic acid and boil slowly 20 minutes (reserve some water for adding to prevent boiling over). For use add 1 gallon to 20 gallons of water. For Mealy Bugs or Scale.

11. Soap Solution. Kitchen formula:

1¼ inch cube soap, 1 gallon warm water.

12. Fish Oil Soap:

Water 6 gallons

Lye (98%) 2 pounds

Fish oil 1½ gallons

Add lye to water in boiler. When dissolved and water boiling, pour in the fish oil, stirring in meantime, and boil slowly for two hours. This will give about 40 pounds soap. For use dilute with 5 to 15 gallons water for each pound. For same pests as No. 9.

13. Tobacco or Nicotine:

- a. Blackleaf 40 (40% nicotine)..... 1 pint
 Water200 gallons
- b. Tobacco stems 1 pound
 Water 4 gallons

Steep stems in 1 gallon warm water and dilute to 4 gallons. For plant lice and other sucking insects during growing season. For Woolly Aphis and Peach Aphis underground. A liberal solution, or the dry dust in early winter, about the base of the tree, the surface soil being first removed.

14. Tobacco Soap:

- Blackleaf 40(1-10 gal.) 1 pound
- { Cresol soap 1 gallon
- Or
- { Whale-oil soap 10 pounds
- Water200 gallons

The cresol soap requires no heating. Use same as 13. Penetrating and wetting power better.

15. Lime Sulphur Tobacco:

- Commercial lime sulphur 36°..... 20 gallons
- Blackleaf 40 14 fluid oz.
- Water200 gallons

For Orange Thrips.

16. Carbolic Lime:

- Quicklime150 pounds
- Crude carbolic acid..... 2 gallons
- Water200 gallons

For Pear Thrips.

17. Sulphur:

- a. Dry. Thoroughly dust over the foliage, preferably when moist with dew. Hydrated lime, about equal parts with sulphur will increase adhesiveness.
- b. Spray. Sulphur 30 pounds, lime (as milk of lime) 15 pounds, water 200 gallons.
- c. Spray. Commercial lime sulphur 4 to 5 gallons, water 200 gallons.

For Red Spiders and Silver Mite.

18. Lead Arsenate:

Lead arsenate6 to 12 pounds
Water200 gallons

First mix arsenate with 2 or 3 gallons of water. For Coddling Moth and most defoliating insects.

19. Lead Aresnate. Kitchen formula:

Lead arsenate1 tablespoonful (1 oz.)
Water1 gallon

20. Paris Green:

Paris green1½ to 2 pounds
Water200 gallons

For Coddling Moth and most defoliating insects. Not to be used along coast or moist situations where injury is likely to result to foliage.

21. Paris Green. Kitchen formula:

Paris green(¼ oz.) 1 teaspoonful
Lime3 teaspoonfuls
Water2 gallons

22. Poisoned Bait:

Bran10 pounds
{ Paris green1 pound
 Or
{ White arsenic½ pound
Water2 gallons
Molasses½ gallon

Mix paris green with bran dry. Add molasses to the water and mix into the bran, making a moist paste. For Cut Worms and Grasshoppers, distribute a small handful about the base of the vines or tree, or scatter about plants in the garden. May be distributed broadcast for Grasshoppers and Army Worms.

23. Poisoned Bait. Kitchen formula:

Bran1 quart
Paris green1 teaspoonful
Molasses1 teaspoonful

24. Tree Barriers:

a. Tree Tanglefoot.

Mix with a gentle heat one pound of resin and one gallon of castor oil, and when cold thin as desired with more castor oil. One of the best ways to apply it is to saturate a piece of baling rope with the well thinned mixture and tie around the trunk of the tree. This will remain sufficiently sticky about ten days, as long as anything of the kind we know of. A strip a few inches wide surrounding the tree trunk, placed in the fall and tended during the winter to prevent the ascent of the Canker Worm Moth. Placed in Hop Vines to prevent ascent of the Hop Flea Beetle. To bar Argentine Ants or most other insects that reach the foliage by crawling only.

b. Cotton Bands:

A four inch strip tied round the tree by a string at the lower edge, and the top then pulled down over the string is in use against Fuller's Rose Beetle on the orange, and other beetles and worms. See State Experimental Station Bulletin No. 214.

c. Mosquito Wire Netting:

This similarly applied is in use against the Canker Worm.

d. Asphaltum:

A strip 6 to 8 inches wide painted about base of tree trunk to prevent the entrance of the Peach Tree Borer.

25. Ground Barriers:

A deep furrow with straight side next to the field to be protected will stop the progress of Army Worms. Holes 8 or 10 inches deep and 20 or 30 feet apart may be dug in the furrow. The worms upon falling in these may be killed by pouring in a small amount of gasoline and throwing in a lighted match, or oil, hot water, or other means as seems desirable.

26. Carbon Bisulphide:

For treatment of stored products and underground insects.

Usual dosage, 1 pint to 1000 cubic feet space.

Place liquid in saucers or shallow vessels above material to be treated. Inflammable; avoid lights.

For underground insects, a tablespoonful in holes 3 or 4 feet apart.

27. Cyanide of Potassium:

One ounce to one gallon of water poured into a trench surrounding a tree affected with Woolly Aphis or Black Peach Aphis is an excellent remedy. Use two to five gallons of the mixture according to the size of the tree to be treated. Too strong a dose is apt to injure the tree.

28. Hydrocyanic Acid Gas:

Potassium cyanide (98%).....	1 ounce
Sulphuric acid (93%)	1 fluid oz.
Water	3 fluid oz.
Or	
Sodium cyanide (129%).....	$\frac{3}{4}$ ounce
Sulphuric acid (93%).....	$1\frac{1}{8}$ fluid oz.
Water	$1\frac{1}{2}$ fluid oz.

Place water and acid in earthenware vessel and add cyanide. To be used under tents or in tight rooms or boxes. This formula is a standard dose for 100 cubic feet of space within a tent stretched over a tree or nursery stock to be fumigated for Red or Purple Scale. Three-fourths of this amount is right for Black Scale in the fall months. In a tight building or tight box, one-half of this dose is enough. In all cases leave exposed for one hour.

For scale insects on citrus trees, maximum or Purple and Red Scale dosage can be found by multiplying distance around by distance over the top of tented tree and pointing off two places. Example:

$$\begin{array}{rcl} \text{Distance around} & & \text{Distance over} \\ 40 \text{ feet} & \times & 20 \text{ feet} = 8 \text{ ounces cyanide} \end{array}$$

For Black Scale reduce one-quarter.

29. Resin Dipping Solution:

Resin	20 pounds
Caustic soda or lye.....	8 pounds
Fish oil	3 pints
Water	100 gallons

Boil resin and caustic soda in 50 gallons of water for one hour. Dilute to 100 gallons. In use for dipping citrus nursery stock for scale insects and Red Spiders. Kerosene emulsion and lime sulphur also used for dipping deciduous nursery stock.

30. Kerosene or Crude Oil:

A thin film spread over the surface of a mosquito-breeding pool or container will destroy the wrigglers. For large scale work, the cheaper crude oil may be used and evaporation will occur less rapidly. Four parts of heavy oil 18° to one part light oil 30° to 35° gravity will spray readily from nozzles. Drainage or other permanent work should have precedence over temporary treatments.

31. Pyrethrum or Buhach:

Fresh material dusted around floors and walls will reduce the number of fleas and other household insects.

32. Formalin: A 5% solution of formaldehyde sweetened with sugar and placed in shallow vessels makes a satisfactory fly poison.

Proper disposal of manure and garbage, however, is the basis for house-fly control.

33. Ant Poison:

Syrup containing between $\frac{1}{4}$ and $\frac{1}{8}$ of one per cent arsenic. A sponge saturated with the arsenic solution and placed in a small fruit jar with perforated cover should be placed where ants frequent. Carbon bisulphide or cyanide solution may be applied to the nests in the ground.

Fungicides

1. Bordeaux Mixture:

Nearly fill two 50 gallon barrels with water; put 50 pounds of bluestone in a sack and suspend near the top in one barrel. This plan hastens it in dissolving. Then slack 50 pounds of good stone lime by adding a little water at a time, stirring it to a thick smooth paste, then add water to make a liquid, then pour it into the other barrel. Now each gallon from these barrels will contain one pound of the solid ingredients. Nearly fill two other barrels or the spray tank with cold water and strain in the stock solutions both kinds running slowly at the same time while the water is well stirred. The proportions are bluestone 5 pounds, lime 6 pounds and water 50 gallons. These proportions may vary from 3 to 8 pounds of bluestone, always using a little more than an equal weight of lime. The leafless tree will bear much stronger spray than the leaves, and it can be used much stronger in rainy weather than in fair weather. Keep it well stirred when spraying.

Bordeaux Mixture is the standard fungicide and is used for Mildew, Peach Leaf Curl, Celery Blight, and all fungus diseases.

2. Formaline or Corrosive Sublimate:

1 pint formalin (40% strength) in 30 gallons of water.

Or

2 ounces Corrosive Sublimate in 15 gallons of water.

Will tend to prevent scab in potatoes if the seed is dipped in it before planting.

3. Iron Sulphide Spray:

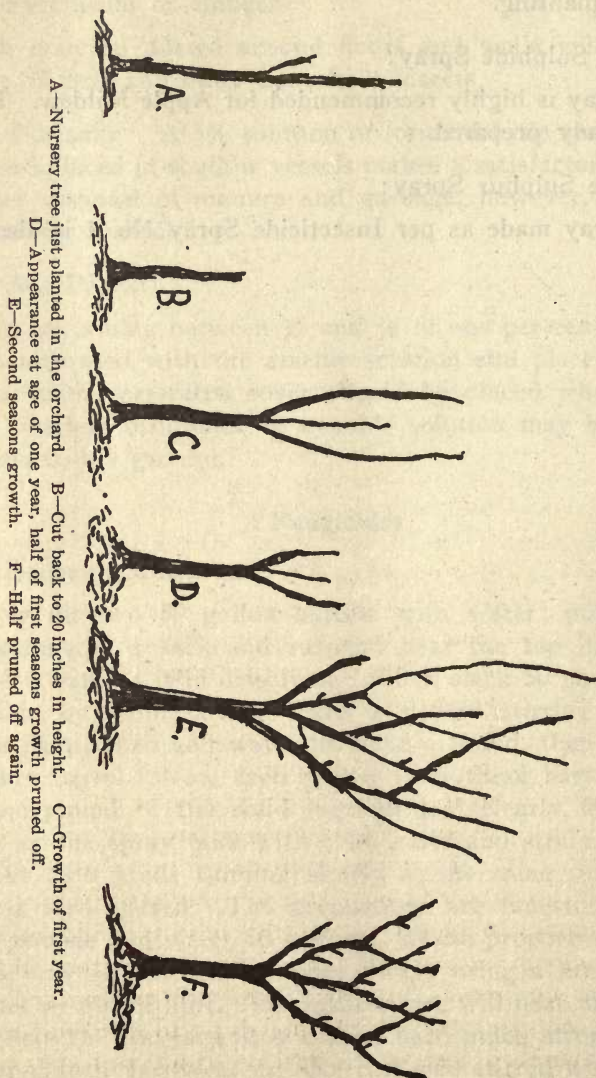
This spray is highly recommended for Apple Mildew. It can be bought ready prepared.

4. Lime Sulphur Spray:

This spray made as per Insecticide Spray No. 1 is also a good fungicide.

PRUNING

This is a very puzzling subject to beginners in horticulture, or to newcomers from Eastern States, and experience only will give a thorough knowledge of it; but a few general statements on it might be of material assistance, while leaving them free to adapt their methods to their own localities, climate, or the special needs of their trees.



This illustration gives a general idea of the growth and pruning of young apple, plum, pear, and apricot trees.

Peach trees should be pruned in about the same way, but as they grow faster, a larger top will be obtained in the same time. Citrus trees need little pruning for the first six years, but let them branch about two feet from the ground and shape the top a little, cutting back any branches which become too prominent.

As the deciduous trees grow older, less pruning will be required, but they must be kept cut down to any height or shape desired. The tree should be kept low enough for convenient care and fruit picking but not so low that, to obtain the desired size of the top they will become too wide, and thus interfere with cultivation. The shape of the tree can often be corrected by weighting down the branches on the side of light growth, thus making them more spreading. The checking of the upward growth also stimulates fruit production.

Unthrifty trees of all kinds should be severely pruned, as the more new wood can be grown into the top the better, but they should be well fertilized at the same time.

Winter is the best time to prune deciduous trees and wood growth is stimulated thereby more than by work done in the summer, but fall pruning of citrus trees produces wood, while spring pruning stimulates fruit production.

A tree bearing only on alternate years can often be induced to bear better crops on the "off" years by severe pruning and the thinning of the fruit, on fruitful years. Good habits in trees as in people can be much promoted by proper training when young.

In this climate, the tops of the deciduous trees should not be much thinned out but should be kept compact, as much of the fruit is produced in the center of the tree. The branches also are kept stocky and strong to bear up the fruit, and vigorous new growth produced by outside pruning shades the fruit and prevents sunburn, especially of apricots.

Citrus trees, however, produce the best results when well thinned out after the age of six or seven years, so that the foliage and fruit will be nearly all on the outside of the tree; and on any kind of a tree, a dead or useless branch should be removed. This especially applies to sucker growths. These are vigorous, upright shoots, springing up through the center of the trees like a new tree starting up from a branch. They are useless and in their growth use nourishment which should go to the support of the tree. Cut them off close to the parent branch as soon as noticed.

NOXIOUS WEEDS

Johnson Grass (*Sorghum halepense*)

This very formidable plant pest in many localities seems especially adapted to some of the loose soils of our County, and to people living there no description is necessary. But it is scattered in patches all over the County, especially in the washes south of



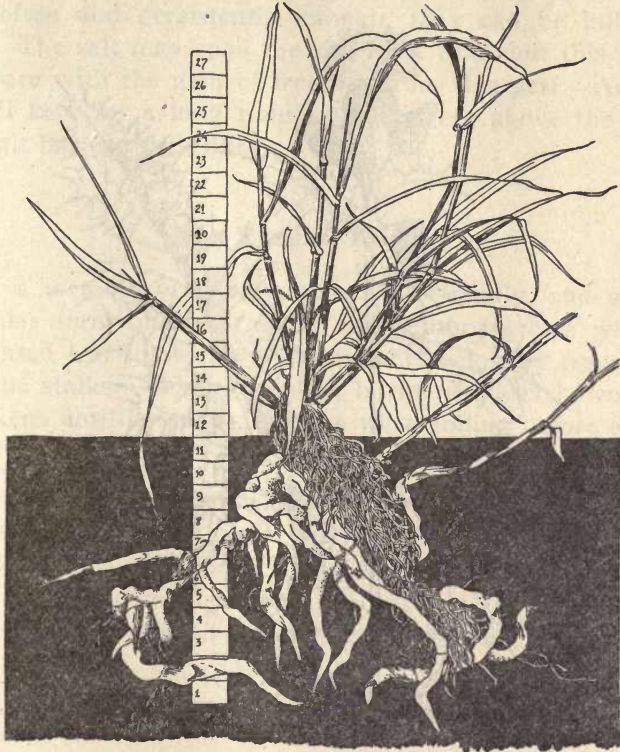
Johnson Grass (*Sorghum halepense*)
A—Growth first year. B—Older plant, deeper root.

the mountains, and many persons would like to know it when they see it, and know how to get rid of it.

The blades of this grass are often half an inch wide and of corresponding length, and the strong stalk grows to a height of three feet or more, topped by a bushy head looking somewhat like sorg-

hum or broom corn in miniature, having the same reddish tinge, but more drooping like oats, and the seed is nearly round. In a favorable spot the grass will grow as thick as possible, but there are seldom stalks enough to hide the leaves near the ground, where they are very thick.

To eradicate this grass, first plow it well, or if fences, trees, etc., prevent that, dig it up by hand, and in either case, rake out all the roots possible with potato hooks; but you will never get them



Johnson Grass-root System.

all and as soon as the remaining ones send up shoots again, go over it again with the tool most conveniently used, and cut off every shoot below the surface, and this should be done as often as they spring up until they cease to show themselves, when the roots have become exhausted and died. Ordinarily the grass can be killed out in a season if kept at persistently and cut off under ground often enough, but in just the right kind of moist sandy loam it may take longer.

The roots are very large and vigorous, and often go very deep,

but if growth to the air can be prevented, they will die in time. It is a misdemeanor in this State to allow the growth of this grass, and no matter how small the patch, it should be vigorously attacked and killed, as the future will well reward you for doing so, and your neighbors will "bless you" for removing the dangerous pest from the vicinity.



Canada Thistle.

Canada Thistle

This is a comparatively small member of the thistle family but so persistent when established that the first sign of its arrival should call for very active efforts to kill it out completely.

The leaf has a scalloped and ruffled appearance, and on each curl of the ruffle is a thorn, with many other thorns about the stalks. These stalks are never more than two feet high, often

much shorter, slender and topped with a bloom much like that of the Bull Thistle, but never more than an inch across. The bulb where it joins the stalk is smaller in proportion also, and the bloom more widely spread and flat. The color of the bloom is purple.

In small patches cut the plants off below the surface, the deeper the better, and apply salt freely. Watch carefully and as soon as any plants appear cut them off again and salt again, and if this is done often and persistently enough, they can be killed in a summer. The salt may spoil the soil for a time, but this loss will not compare with the gain of freedom from this pest. Any plant will die if kept for a long time from growing above the surface, but the salt hastens the killing.

The Russian Thistle

This is a member of the "tumble weed" family, and grows in the globular form of these plants. The thorn grows where the small pointed leaf joins the stalk, and little flowers come on the sides of the stalks. When the plant is ripe the attachment to the root weakens until it breaks, and the weed rolling before the wind often scatters its seed over a very wide territory.

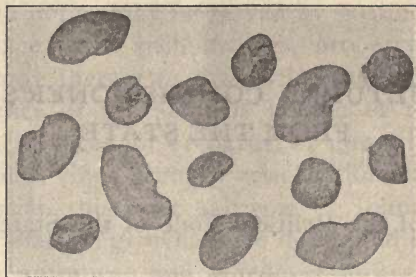
It is an annual plant, growing entirely from the seed, and not much harder to kill out than a host of other annual weeds which we yearly combat. Of course, it is one more variety, and when just getting started in a neighborhood should be exterminated if possible, and that is not a very difficult undertaking.

Wild Morning Glory

A great pest in some localities, and entirely immune to ordinary crop cultivation. By continuous cultivation with sweep cultivators, and hoes where necessary, its seeding may absolutely be prevented and this treatment continued in all seasons will prevent the weed from making much growth above the surface. If it can get no growth in the air any ordinary plant will die in time, and the morning glory is no exception. Patience and persistence are the remedies. Every green sprout must be cut off below the surface once a week in the growing season. The plant will then starve, but it may take two years.



Russian Thistle (*Salsolipali*)
a—Branchlet showing leaves. b—Seed-pod magnified. c—Branchlet showing
spiny bracts and blossoms natural size.



Seeds of clover dodder and white clover, showing relative sizes. Enlarged.

Love Vine or Dodder

This is the bright yellow or orange colored vine seen in various uncultivated places running over the weeds or brush, or much worse, in alfalfa fields. It is of the morning glory family, but when well started fastens itself to the stalk of its host plant, its root dies, and it becomes a parasite, drawing nourishment from the plant supporting it. Fire is the only remedy. Cut and pile the vine and host plant, put on more rubbish if obtainable, to cover the whole patch, and burn, and do this before the dodder seeds. Look out for it in alfalfa seed. You can detect it with a pocket glass.

Detection of the presence in commercial seed of dodder, irrespective of its kind, demands first consideration, because its presence justifies refusal to purchase such seed. A magnifying glass is necessary, as it will enable one to readily distinguish any kind of dodder seed from clover, alfalfa, or flax seed. Dodder seeds are, as a rule, about the same size as red clover seeds, including the smallest and largest seeds. The surface is finely roughened and dull, and the general form varies from nearly spherical to strongly flattened and oval or nearly circular. The color is gray, yellowish brown, or reddish brown, depending largely on the kind. In contrast, clover and alfalfa seeds are smooth, often with a slight luster. Their triangular, oval, or kidney form aids in distinguishing them from seeds of the dodder.

Cockle Burr

Never let it seed. It will perhaps need watching for several years as the burrs, if buried several inches deep by the plow, lay dormant in the ground, but grow when in subsequent years they are thrown up nearer the surface. The oily nature of the seed preserves it in the ground for years.

THE HORTICULTURAL COMMISSIONER'S AUTHORITY FROM THE STATE

Section 2322a of the Political Code of the State of California is as follows:

It shall be the duty of the county horticultural commissioner in each county, whenever he shall deem it necessary, to cause an inspection to be made of any premises, orchards or nursery, or trees, plants, vegetables, vines, or fruits, or any fruit-packing house, store-room, salesroom, or any other place or article in his jurisdiction, and if found infected with infectious diseases, scale insects, or coddling moth, or other pests injurious to fruit, plants, vegetables, trees, or vines, or with their eggs, or larvae, or if there is found growing thereon the Russian thistle or saltwort, Johnson grass or other noxious weeds, he shall, in writing, notify the owner or owners, or person or persons in charge, or in possession of the said places or orchards or nurseries, or trees, or plants, vegetables, vines, or fruit, or article as aforesaid, that the same are infected with said diseases, insects or other pests, or any of them, or their eggs or larvae, or that the Russian thistle or saltwort, Johnson grass or other noxious weeds is growing thereon, and require such person or persons, to eradicate or destroy the said insects, or other pests, or their eggs or larvae, or Russian thistle or saltwort, Johnson grass or other noxious weeds within a certain time to be therein specified. Said notices may be served upon the person or persons, or either of them, owning or having charge, or having possession of such infested place or orchard, or nursery, or trees, plants, vegetables, vines, or fruit or articles as aforesaid, or premises where the Russian thistle or saltwort, Johnson grass or other noxious weeds shall be growing, or upon the agents of either by any commissioner, or by any person deputed by the said commissioner for that purpose in the same manner as a summons in a civil action; provided, however, that if any such infected or infested articles, property or premises as hereinabove specified belong to any non-resident person and there is no person in control or possession thereof and such non-resident person has no tenant, bailee, depositary or agent upon whom service can be had; or if the owner or owners of any such articles, property or premises can not after due diligence be

found, then such notice may be served by posting the same in some conspicuous place upon such articles, property or premises, and by mailing a copy thereof to the owner thereof at his last known place of residence, if the same is known or can be ascertained. Any and all such places, or orchards, or nurseries, or trees, plants, shrubs, vegetables, vines, fruit, or articles thus infested, or premises where the Russian thistle or saltwort or Johnson grass or other noxious weeds shall be growing, are hereby adjudged and declared to be a public nuisance; and whenever any such nuisance shall exist at any place within his county, and the proper notice thereof shall have been served, as herein provided, and such nuisance shall not have been abated within the time specified in such notice, it shall be the duty of the county horticultural commissioner to cause said nuisance to be at once abated, by eradicating or destroying said diseases, insects, or other pests, or their eggs, or larvae, or Russian thistle or saltwort or Johnson grass or other noxious weeds. The expense thereof shall be a county charge and the board of supervisors shall allow and pay the same out of the general fund of the county. Any and all sum or sums so paid shall be and become a lien on the property and premises from which said nuisance has been removed or abated in pursuance of this chapter. A notice of such lien shall be filed and recorded in the office of the county recorder of the county in which the said property and premises are situated, within thirty days after the right to the said lien has accrued. An action to foreclose such lien shall be commenced within ninety days after the filing and recording of said notice of lien, which action shall be brought in the proper court by the district attorney of the county in the name and for the benefit of the county making such payment or payments, and when the property is sold, enough of the proceeds shall be paid into the county treasury of such county to satisfy the lien and costs; and the overplus, if any there be, shall be paid to the owner of the property, if known, and if not, into the court for his use when ascertained. The county horticultural commissioner is hereby vested with the power to cause any and all such nuisances to be at once abated in a summary manner.

COUNTY REGULATIONS

For Admission, Inspection and Treatment of Trees and Nursery Stock

All trees and plants transported into the County must bear a tag showing where grown and by whom, and must be inspected by the Horticultural Commissioner or his Inspector, and bear his certificate of freedom from harmful insects or diseases before delivery to the consignee. (Los Angeles County Ordinance No. 42 N. S.)

This ordinance has been amended as follows:

Ordinance No. 312 (New Series)

An Ordinance to amend Ordinance No. 42, New Series, entitled "An Ordinance to promote the horticultural interests of Los Angeles County, California, and providing for the inspection and destruction of insect pests, and providing for restrictions upon the importation of cuttings, etc.," by inserting therein between Sections 1 and 2 thereof a section to be known as Section 1½.

The Board of Supervisors of the County of Los Angeles do ordain as follows:

Section 1. That Ordinance No. 42 (New Series) entitled, "An Ordinance to promote the horticultural interests of Los Angeles County, California, and providing for the inspection and destruction of insect pests, and providing for restrictions upon the importation of cuttings, etc.," be and the same is hereby amended by inserting therein between Sections 1 and 2 thereof a new section to be known as Section 1½ and to read as follows, to wit:

"That no person or person, firm or corporation, either as owner, agent, factor, broker, servant or other employee shall bring for delivery, or cause to be brought for delivery, from one section of the County of Los Angeles to another section of the County of Los Angeles any trees, plants, vines, shrubs, scions, cuttings, buds or grafts, without giving written notice of their arrival at their destination within twenty-four hours thereafter, and prior to removal from said point of destination, to the horticultural commissioner of said county, or to the local inspector of the district into which the same are so brought, nor shall either the persons, parties

or corporations above named remove the same from the place of their destination until inspected as hereinafter provided.

"That any person or persons, corporation or corporations mentioned in Section 1 of this ordinance who shall ship or bring, or cause to be brought or shipped from one section of Los Angeles County to another section of Los Angeles County, any trees, scions, cuttings, buds, grafts, shrubs or plants, shall have placed upon or securely attached to each package, box or separate parcel of such articles a distinct mark or label showing the name of the owner, agent or shipper, the name of the grower and the place where grown.

"All of the provisions of this ordinance applying to shipments from without the County of Los Angeles into the County of Los Angeles shall apply equally to shipments from one section of the County of Los Angeles to another section of the County of Los Angeles."

Section 2. The Board of Supervisors finds that this ordinance is needed for the immediate preservation of property in the County of Los Angeles for the reason that plants, cuttings, shrubs, vines and other articles of like nature are being shipped from one section of the county to another section of the county, thus spreading disease and parasites among the horticultural sections of Los Angeles County, and for that reason it is hereby ordered that this ordinance shall be published for at least one week in The Los Angeles Daily Journal, a newspaper printed and published in the County of Los Angeles, together with the names of the members of the Board of Supervisors voting for and against the same, and that fifteen days after the passage of this ordinance the same shall take effect, to wit, on the 8th day of October, 1912.

R. W. PRIDHAM,

Chairman Board of Supervisors of County of Los Angeles, State of California

Attest:

H. J. LELANDE,

County Clerk and ex officio Clerk of the Board of Supervisors

All trees and plants to be transported must be inspected before moved by the Horticultural Commissioner or his Inspector, and bear his certificate of freedom from harmful insects or diseases. (Los Angeles County Ordinance No. 220 N. S.)

All fumigators and sprayers doing public work outside incorporated cities must obtain licenses from the County, granted on approval of the Horticultural Commissioner. (Los Angeles County Ordinance No. 245, N. S., Sec. 53 and 54.)

STATE QUARANTINE ORDERS

No nursery stock or plants liable to infestation by citrus white fly will be admitted from the States bordering on the Gulf of Mexico, or from North Carolina or South Carolina.

No stone fruit trees will be admitted from States east of Mississippi River.

No fruit or plants will be admitted from Hawaii except banana and pineapple fruit.

No fruit or plants will be admitted from Mexico except sour limes and banana fruit.

No alfalfa or other hay will be admitted from Utah, Idaho or Wyoming.

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